Engineering Library
JUL 23 1930

The Engineer.

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VOL. CL.—No. 3887] LONDON: FRIDAY EVENING, JULY 11, 1930 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

The Director-General,

India Store Department, Belvedere-road, Lambeth, London, S.E. 1, invites TENDERS for :—

SCHEDULE 1.—VACUUM BRAKE FITTINGS : 10,000 Malleable Cast Iron Plugs for Dummy Carriers.

SCHEDULE 2.—HYDRAULIC GATES, VALVES and SCREENS.

SCHEDULE 3.—150 STEEL DRAWBARS for LOCOMOTIVE ENGINES and TENDERS.

Tenders due as follows :—

Schedule 1, 6th August, 1930.

Schedules 2 and 3, 8th August, 1930.

Forms of Tender available from the above at a fee (which will not be returned) of 5s. for each Schedule. 5384

Wanted for the Indian

ORDNANCE FACTORIES

TWO ASSISTANT WORKS MANAGERS.

(1) METAL and STEEL FACTORY, ISHAPORE (near Calcutta).

Applicants should possess a University Degree in Metallurgy, with special knowledge of the Non-ferrous Metals, or an equivalent diploma, and it is desirable that they should also have had at least three years' workshop experience in Brass Casting and Rolling, and/or Rod and Tube Drawing Shops, including experience in the control of labour in some post of authority.

(2) HARNESS and SADDLERY FACTORY, CAWNPORE.

Applicants should possess a University Degree in Engineering or an equivalent diploma, and, in addition, they should have had not less than three years' subsequent practical experience with a firm of Mechanical Engineers of good standing.

For both appointments applicants should be not less than 24 and preferably not more than 35 years of age.

The selected officers will be engaged for a period of five years, with the prospect of permanent retention thereafter. For officers of non-Asiatic domicile, pay will commence at the rate of Rs. 600 basic, plus £25 sterling overseas pay (in all about £70) per mensem. The appointments are non-pensionable, but subscription to a Provident Fund, to which Government also contributes, is compulsory. Free passages to and from India will be given on appointment and on termination of appointment and if the officers remain in the service after the first five years, leave passages to the United Kingdom will be granted.

The officers will be required to proceed to India in September next.

Intending applicants should write to the SECRETARY, Military Department, India Office, London, S.W. 1, for further particulars of the appointments and for a form of application, the latest date for the return of which will be the 19th July, 1930. All communications should be marked "Ordnance Recruitment." 5307

Crown Agents for the COLONIES.

COLONIAL GOVERNMENT APPOINTMENTS.

APPLICATIONS from qualified candidates are INVITED for the following POSTS :—

M/2015.—ASSISTANT ENGINEERS REQUIRED by the GOVERNMENT OF NIGERIA for the PUBLIC WORKS DEPARTMENT for two tours of not less than 12 nor more than 18 months' service in the first instance. Subject to satisfactory service, the officers appointed will be eligible at the expiration of three years' service for confirmation in the permanent and pensionable establishment. Salary £480 a year for the first three years ; then £510, rising by annual increments to £920. Outfit allowance of £60 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates must have attained the age of 21½ years on the date of appointment, and should preferably have attained the age of 22½ and must not be over 35 years of age. Must have obtained an Engineering Degree at a recognised University or have passed Sections "A" and "B" of the A.M.I.C.E. examination or have passed the Associateship in Civil Engineering of the City and Guilds Institute, or possess such other Degree or Diploma or distinction in Engineering as may be considered satisfactory. Candidates whose qualifying diplomas have been obtained without a College course should have had three years' practical experience of Civil Engineering under a qualified Civil Engineer. It is preferred that all candidates should have had two years' practical experience on good engineering work, subsequent to taking their degree or completing their articles, but under certain conditions this may be waived in the case of candidates in possession of an Engineering Degree.

M/2356.—ASSISTANT ENGINEER REQUIRED by the PUBLIC WORKS DEPARTMENT, KENYA, for a tour of 29-30 months' service and with possible extension. Salary £480, rising to £600 a year by annual increments of £20, and thence rising to £720 a year by annual increments of £30. Free quarters and passages, liberal leave on full salary. Candidates, 25-35 years of age, must have passed Sections "A" and "B" of the examination of the A.M.I.C.E. diploma, or hold qualifications recognised by the Institution of Civil Engineers as exempting from those examinations. Must have had good all-round experience in the Survey, Design and Execution of Engineering and Building Works of a public character (e.g., Roads, Bridges, Public Buildings, Drainage Schemes, Water Supplies) and Preparation of Estimates, Specifications, &c., in connection therewith.

Apply at once by letter, stating age, whether married or single and full particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting the reference number against the appointment for which application is made. 5394

Ministry of Health.

ENGINEERING INSPECTOR.

APPLICATIONS are INVITED by the Minister of Health for APPOINTMENT as ENGINEERING INSPECTOR.

The salary commences at £600 per annum and rises by yearly increments of £25 to a maximum of £1000. In addition to the salary a bonus, which varies with the Cost of Living, is payable. The bonus on the minimum salary is at present £176 7s.

The appointment will carry the usual Civil Service conditions as to pension, holidays, &c.

Candidates must be Chartered Civil Engineers having had wide experience in the Designing and Carrying Out of Works, especially Works of Sewerage and Sewage Disposal. Special consideration will be given to candidates with an Honours Degree in Engineering.

Preference will be given to candidates who served in His Majesty's Forces during the War.

The successful candidate will be required to devote whole time to the Public Service and must be prepared to take up duties without undue delay. The Headquarters of the Engineering Inspectors are in London.

Canvassing Members of Parliament or Officers of the Ministry will render a candidate liable to disqualification.

Forms of application, with further particulars of the appointment, may be obtained from—

THE DIRECTOR OF ESTABLISHMENTS,
Ministry of Health,
Whitehall, S.W. 1.

No application will be considered unless received on the prescribed form not later than the 21st July, 1930. 5309

The Engineer

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PUBLIC NOTICES

PATENTS AND DESIGNS ACTS, 1907 TO 1928.

Notice is Hereby Given that

CORNELIS ANDRIES HEERO MULDER, of 2, Treurenburgstraat, Eindhoven, Holland, SEEKS LEAVE to AMEND the SPECIFICATION of LETTERS PATENT No. 296,727, granted to him for an invention entitled "Improvements in and relating to Stands and like Supports for Drawing Boards, Guns, Telescopes and other Articles."

Particulars of the proposed Amendment were set forth in No. 2163 of the "Illustrated Official Journal (Patents)," published on July 2nd, 1930.

Any person or persons may give Notice of Opposition to the Amendment by leaving Patents Form No. 19 at the Patent Office, 25, Southampton-buildings, London, W.C. 2, within one calendar month from the date of publication of the said Journal.

W. S. JARRATT,
Comptroller-General.

P44

The Royal Technical College,

GLASGOW.

DEPARTMENTS OF ENGINEERING.

MECHANICS AND MECHANICAL ENGINEERING : Professor ALEXANDER L. MELLANBY, D.Sc., M.I. Mech. E.
Associate Professor WILLIAM KERR, Ph.D., A.R.T.C., M.I. Mech. E.
ELECTRICAL ENGINEERING : Professor STANLEY PARKER SMITH, D.Sc., M.I.E.E., A.M. Inst. C.E.
CIVIL ENGINEERING : Professor GEORGE MONCUR, B.Sc., M. Inst. C.E., M. Amer. Soc. C.E.
MINING ENGINEERING : Professor DANIEL BURNS, M. Inst. M.E.
CHEMICAL ENGINEERING : Professor of Technical Chemistry : THOMAS GRAY, D.Sc., LL.D., Ph.D., F.I.C.

Complete courses of instruction are provided, qualifying for the Diploma and Associateship of the College and for the Degree of B.Sc. in Engineering of Glasgow University.

Composition fee, 25 guineas per annum.

SESSION 1930-31 BEGINS on TUESDAY, SEPTEMBER 23rd.

Calendar, by post 3s., and prospectus, gratis, may be obtained on application to the SECRETARY. 5365

PUBLIC NOTICES

Heriot-Watt College, Edinburgh

DEPARTMENTS OF MECHANICAL ENGINEERING AND ELECTRICAL ENGINEERING.

MECHANICAL ENGINEERING :
PROFESSOR A. R. HORNE, O.B.E., B.Sc., M.I. Mech. E., A.M.I.C.E.
ELECTRICAL ENGINEERING :
PROFESSOR F. G. BAILY, M.A., M.I.E.E.

FULL-TIME DAY DIPLOMA COURSES leading to professional recognition.

CLASSES COMMENCE 14th OCTOBER.

Full particulars from the College.

J. CAMERON SMAIL, O.B.E., Principal. 5268

University of Bristol.

FACULTY OF ENGINEERING.

(Provided and Maintained in the MERCHANT VENTURERS' TECHNICAL COLLEGE).

Vice-Chancellor : T. LOVEDAY, M.A., LL.D.
Dean of the Faculty :
ANDREW ROBERTSON, D.Sc., M.I. Mech. E., M. Inst. C.E.

DEPARTMENTS.

CIVIL ENGINEERING : Prof. A. J. SUTTON PIPPARD, M.B.E., D.Sc., M. Inst. C.E., M.I. Mech. E., F.R.Ae.S.
MECHANICAL ENGINEERING : The DEAN.
ELECTRICAL ENGINEERING : Prof. DAVID ROBERTSON, D.Sc., M.I.E.E.
AUTOMOBILE ENGINEERING : Prof. W. MORGAN, B.Sc., M.I.A.E.
MATHEMATICS : Prof. E. S. BOULTON, M.A., B.Sc.
GEOLOGY : Prof. S. H. REYNOLDS, M.A., Sc.D.
CHEMISTRY : Prof. F. FRANCIS, D.Sc., Ph.D., F.I.C.

Complete Courses of Study extending over three years leading to the University Degree or Diploma in Civil, Mechanical, Electrical or Automobile Engineering.

Full particulars of Courses and of the University Halls of Residence may be obtained on application to the REGISTRAR, M.V.T. College, Bristol.

The SESSION 1930-31 COMMENCES on OCTOBER 3rd. 5363

PUBLIC NOTICES

The University of Sheffield.

SESSION 1930-31.

Vice-Chancellor : A. W. PICKARD CAMBRIDGE, M.A., D.Litt.

DEPARTMENTS OF MECHANICAL, ELECTRICAL, AND CIVIL ENGINEERING, METALLURGY, MINING, FUEL TECHNOLOGY, AND GLASS TECHNOLOGY.

The Courses in the above Departments extend over three or four years and prepare students to become specialists in one or other of these branches of Applied Science.

The LECTURE COURSES in all the Departments are supplemented by Practical Training in Laboratories and Workshops, which are fully equipped for the purpose of advanced scientific teaching, investigation and research.

Part-time Courses are arranged for students who desire to take special portions of any of the regular Courses.

In Mining Engineering and in certain of the Courses in Mechanical and Electrical Engineering, and in Glass Technology, arrangements are made to enable students who come to the University from works or collieries to take six months' Courses of study at the University and six months' practice at the works or colliery each year for a period of four years. During the first year such students should spend three terms at the University.

RESEARCH Fellowships and Scholarships are awarded annually.

The LECTURE COURSES commence OCTOBER 1st, 1930.

The TECHNICAL LABORATORY COURSES commence SEPTEMBER 23rd, 1930.

Particulars of Entrance and Research Scholarships available will be sent on application.

For further details of the Courses and for particulars of the Degrees, Associateships, Diplomas, and Certificates awarded on their successful completion, application should be made to

W. M. GIBBONS,
Registrar.

5378

University College of Swansea.

(A Constituent College of the University of Wales).

Principal : C. A. EDWARDS, D.Sc., F.R.S.

APPLIED SCIENCE DEPARTMENTS.

ENGINEERING.

Professor : FREDERIC BACON, M.A. (Cantab.), A.M. Inst. C.E., M.I. Mech. E., M.I.E.E.
Lecturer in Electrical Engineering : R. G. ISAACS, M.Sc. (Bristol), B.Sc. (Lond.), A.M.I.E.E.
Lecturer in Civil Engineering : A. A. FORDHAM, B.Sc. (Lond.), A.M. Inst. C.E., M.I. Struct. E.
Assistant Lecturer : J. SELWYN CASWELL, M.Sc. (Wales), A.M.I. Mech. E.

METALLURGY.

Professor : C. A. EDWARDS, D.Sc. (Manchester), F.R.S.
Assistant Professor : L. TAVERNER, A.R.S.M.
Lecturer : L. B. PFEIL, D.Sc. (Lond.), A.R.S.M.
Assistant Lecturers : J. C. JONES, M.Sc. (Wales).
R. GRIFFITHS, B.Sc. (Wales).

The College offers a number of exceptional advantages to Students who aim at entering upon professional careers in Engineering or in Metallurgy. It is situated in the heart of an industrial area which includes a large number of works of very varied character, and presents an unrivalled variety of metallurgical practice. The manufacturers of the district, who contribute largely to the support of the College, give the Staff and Students of the Applied Science Departments every access to the works, and the Managers, Engineers, and Technical Officials co-operate with the Staff of the College in making visits to works of practical educational value to the Students.

Courses of study are provided (1) for the B.Sc. Degree of the University of Wales in (A) Civil Engineering, (B) Mechanical Engineering, (C) Electrical Engineering, (D) Metallurgy ; and (2) for Diplomas of the College in (A) Civil Engineering, (B) Mechanical Engineering, (C) Electrical Engineering, (D) Metallurgy.

Persons who are not desirous of studying for Degrees or Diplomas may attend selected College Classes, provided they satisfy the authorities of the College that they are qualified to benefit by such Classes.

Entrance Scholarships will be offered for competition in September, 1930.

Particulars concerning admission to the College and of the Entrance Scholarships may be obtained from the undersigned.

EDWIN DREW,
Registrar.

Singleton Park, Swansea. 5364

Cornwall County Council.

TORPOINT FERRY.

The Cornwall County Council invites TENDERS for the CONSTRUCTION of a Large FLOATING BRIDGE propelled by Steam for use on its Ferry Service between Devon and Cornwall.

Copies of the drawings and specification and a form of Tender may be obtained from the undersigned on payment of Two Guineas, which will be returned on receipt of a bona fide Tender, and, if the Tender is not accepted, on the return of all papers and documents.

Tenders, endorsed "Floating Bridge," should be received by the undersigned not later than the 1st August, 1930.

The Council does not bind itself to accept the lowest or any Tender.

T. A. H. SHEERS,
Clerk of the County Council.

County Hall, Truro,
30th June, 1930. 5311

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PUBLIC NOTICES

University of Liverpool.

SESSION 1930-1931.

Prospectuses and full particulars of the following may be obtained on application to the REGISTRAR:

UNIVERSITY CALENDAR (price 2s. 6d., post free 3s.).
FACULTIES OF ARTS, SCIENCE, MEDICINE, LAW, AND ENGINEERING.
LIVERPOOL SCHOOL OF ARCHITECTURE.
DEPARTMENT OF CIVIC DESIGN.
INSTITUTE OF ARCHÆOLOGY.
DEPARTMENT OF EDUCATION.
LIVERPOOL SCHOOL OF SOCIAL SCIENCES AND ADMINISTRATION (including Economics, Commerce, Geography, and Social Science).
SCHOOL OF RUSSIAN STUDIES.
SCHOOL OF LOCAL HISTORY AND RECORDS.
UNIVERSITY EXTENSION BOARD.
DEPARTMENT OF PUBLIC HEALTH.
LIVERPOOL SCHOOL OF TROPICAL MEDICINE.
SCHOOL OF VETERINARY SCIENCE.
SCHOOL OF DENTAL SURGERY.
DOCTORATE IN PHILOSOPHY.
FELLOWSHIPS, SCHOLARSHIPS, STUDENTSHIPS, EXHIBITIONS, SPECIAL GRANTS AND PRIZES.
HALLS OF RESIDENCE.
JOINT BOARD MATRICULATION EXAMINATION.
AWARD OF SCHOOL CERTIFICATES.
AWARD OF HIGHER SCHOOL CERTIFICATES.

4800

Administrative County of LONDON.

WIDENING OF PUTNEY BRIDGE.

The London County Council invites TENDERS from competent firms for the WIDENING of PUTNEY BRIDGE by adding about 30ft. to the width of the existing structure. The arches of the bridge will be extended on the downstream side, in granite matching in all respects the existing part of the bridge, and the piers in granite-faced concrete founded in caissons sunk in the river bed. The addition to the abutments will be carried out in granite-faced concrete matching the existing work. The contract will also include the formation of the roadway on the widened bridge and its approaches immediately adjacent and the relaying of the tramways in the centre of the widened carriageway.

The specification, bills of quantities, drawings and form of Tender may be obtained, on and after 14th July, 1930, on application to the Chief Engineer, the Old County Hall, Spring-gardens, S.E. 1, upon payment of £10 by cheque, draft, or money order to the order of the London County Council. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application, and the contract documents may be inspected before payment of the fee.

Remittances by post should be addressed to the Chief Engineer, the Old County Hall, Spring-gardens, S.W. 1. Personal inquiries at Room 3A, No. 3, Warwick House-street, Cockspur-street, S.W. 1.

The contractor will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and form of contract and in "The London County Council Gazette."

No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 1st September, 1930, will be considered.

The Council does not bind itself to accept the lowest or any Tender.

MONTAGU H. COX,
Clerk of the London County Council.

5361

Administrative County of LONDON.

HOLBORN TO STRAND IMPROVEMENT, MONTREAL-PLACE.

The London County Council invites TENDERS for the WORK of MAKING UP MONTREAL-PLACE. The contract will include the Paving of the Carriageway in Asphalt or Wood Blocks on Concrete, and the Construction of Ornamental Steps leading from Montreal-place to Aldwych.

The specification, bills of quantities, drawings and form of Tender may be obtained, on and after 14th July, 1930, on application to the Chief Engineer, the Old County Hall, Spring-gardens, S.W. 1, upon payment of £2 by cheque, draft, or money order to the order of the London County Council. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application and the contract, documents may be inspected before payment of the fee.

Remittances by post should be addressed to the Chief Engineer, the Old County Hall, Spring-gardens, S.W. 1. Personal inquiries at Room 3A, No. 3, Warwick House-street, Cockspur-street, S.W. 1.

The contractor will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and form of contract and in "The London County Council Gazette."

No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 28th July, 1930, will be considered.

The Council does not bind itself to accept the lowest or any Tender.

MONTAGU H. COX,
Clerk of the London County Council.

5362

Farnham Urban District COUNCIL.

CONTRACT NO. 6.
MAIN DRAINAGE SCHEME.
TO BRITISH MANUFACTURERS OF UNCHOKEABLE CENTRIFUGAL PUMPING PLANT.

The Farnham Urban District Council are prepared to receive TENDERS for the SUPPLY and ERECTION of TWO ELECTRICALLY DRIVEN UNCHOKEABLE PUMPS, to be installed in the existing Guildford-road Sewage Pumping Station.

The works included in the contract consist of Vertical Electrical Motors with Automatic Starting Gears, Vertical Unchokeable Pumps with Shafts and all necessary Delivery and Suction Pipe Connections, and in accordance with the drawing, general conditions and specification prepared by the Engineers, Messrs. John Taylor and Sons, Caxton House, Westminster, S.W. 1.

The general conditions, specification and copy of the drawing may be obtained by the manufacturer from the offices of the Engineers upon payment of £5 (cheque only), which will be returned upon receipt of a bona fide Tender.

Tenders, in sealed envelopes endorsed "Tender for Sewage Pumping Plant, Contract No. 6," must be delivered at my office at Farnham on or before Noon on Monday, the 21st day of July, 1930.

The Council does not bind itself to accept the lowest or any Tender.

(Signed) A. A. MINNS,
Acting Clerk.

Council Offices,
Farnham, Surrey.

5379

City and County of Kingston-upon-Hull.

WATERWORKS DEPARTMENT.
APPOINTMENT OF CHIEF ENGINEERING ASSISTANT.

APPLICATIONS are INVITED for the POSITION of CHIEF ENGINEERING ASSISTANT in the Waterworks Department.

The salary will be £750 per annum.

Experience in the construction of Pumping Works essential.

The person appointed may be required to undergo a medical examination and to contribute to the Hull Corporation Scheme under the Local Government and Other Officers' Superannuation Act, 1922.

Applications, stating age, particulars of experience and qualifications, and accompanied by not more than three testimonials of recent date, must be addressed to me, endorsed "Chief Engineering Assistant, Waterworks," and delivered at my office not later than 10 a.m. on Saturday, the 19th instant.

J. R. HOWARD ROBERTS,
Town Clerk.

Guildhall, Hull,
3rd July, 1930.

5369

YARROW HOME and HOSPITAL FOR CHILDREN BROADSTAIRS.

For the Early & Preventive Treatment of Disease & Convalescence after illness.

Managed by a Committee appointed by the Council of the Institution of Civil Engineers.

The Hospital is intended for the children of members of the Institution of Civil Engineers, the children of architects, artists, authors, clergymen, members of the medical, legal and other professions, members of scientific societies, officers of the Navy, Army, and Royal Air Force, officers of the Merchant Navy, schoolmasters and university professors.

Accommodation is provided for 50 Boys between the ages of 4 and 12 years, and 50 Girls between the ages of 4 and 14 years. In special cases the age limits may be raised to 14 for Boys and 16 for Girls.

Fee 21/- per week, or as may be arranged, and travelling expenses.

Particulars can be obtained from the Secretary:—
116, Victoria Street, Westminster, LONDON, S.W.1.

LEASE OF IMPOSING OFFICES FOR SALE.
33, NORFOLK STREET, STRAND, W.C.2.

In consequence of the recent amalgamation of "THE ENGINEER" LTD., proprietors of "The Engineer," with MORGAN BROS. (PUBLISHERS) LTD., proprietors of "The Ironmonger" and "The Chemist & Druggist," the offices of the three journals have now been transferred to new and more commodious freehold premises which have been acquired at 28-31, Essex Street, Strand, W.C.2.

The remainder of the lease, covering a further twenty-five years, of the present offices of "The Engineer" at 33, Norfolk Street, Strand, W.C.2, is in consequence for sale. This particularly well lighted five-storey building has an area of 8,200 sq. ft., and occupies a site at the corner of Norfolk and Howard Streets, adjacent to the Temple Station, whence Westminster and the City may be reached in a few minutes. The building is of modern construction and has a fine and distinctive elevation. It is in good order throughout, and vacant possession can now be had. Rent £1,600. Moderate price. For further particulars apply to:—

WHATLEY, HILL & CO.,
24, Ryder Street, St. James', S.W.1.

PUBLIC NOTICES

Bombay, Baroda and Central INDIA RAILWAY COMPANY.

The Directors are prepared to receive up to Noon on Wednesday, 30th July, TENDERS for the SUPPLY of:—

WOOD WORKING MACHINES.

Tenders must be made on forms, copies of which, with specification, can be obtained at these Offices on payment of 10s. each (which will not be returned).

The Directors do not bind themselves to accept the lowest or any Tender.

S. G. S. YOUNG, Secretary.

Offices: The White Mansion,
91, Petty France, S.W. 1,
9th July, 1930.

5381

ASSISTANT WORKSHOPS MANAGER.

The Commissioners of Irish LIGHTS

are prepared to receive APPLICATIONS from persons fully qualified to discharge the duties of ASSISTANT WORKSHOPS MANAGER under the Board.

Applicant must write a good hand, be a competent draughtsman, with a good knowledge of the strength of materials and the calculation of stresses in the working parts of machinery, have had experience of bench and machine work, including working to fine limits, be competent to take control of engine fitters, brassfinishers, smiths, patternmakers and erectors, and must be able to do work at sea in open boats, on lightships, &c.

Experience of internal combustion engines, air compressors, electrical machinery, wireless apparatus and turret clock work will all be considered additional qualifications.

Salary to commence at £140 per annum plus Civil Service scale of bonus, and advance by annual increments of £7 10s. to a maximum of £200 per annum plus bonus.

Travelling expenses and personal allowances granted when absent from headquarters on duty.

Applications, applicant's own handwriting, to be sent to the undersigned, prepaid per post, on or before Wednesday, the 30th July, stating age (which must be under 35 years), education and experience of the applicant, and accompanied by copies of testimonials from actual employers only (which will not be returned), to be endorsed on the cover "Applications for Situation as Assistant Workshops Manager."

By Order,
J. B. PHELPS, Secretary.

Irish Lights Office, Dublin.

5380

Metropolitan Water Board. APPOINTMENT OF DEPUTY CHIEF ENGINEER.

The Metropolitan Water Board invite APPLICATIONS for the APPOINTMENT of DEPUTY CHIEF ENGINEER at a commencing salary of £1200 per annum.

Applicants must be Corporate Members of the Institution of Civil Engineers, and must have had responsible experience with the Water Department of a Public Authority or with a Water Company.

Candidates must also have had considerable experience in the Design, Construction and Maintenance of important Waterworks, and in the general administration of large Waterworks Undertakings.

The successful applicant will be required to pass satisfactorily a medical examination by the Board's Chief Medical Officer, and to undertake in writing to join the Board's Superannuation and Provident Fund.

The appointment will be held during the pleasure of the Board.

Applications, stating age, and particulars of experience, education, training, qualifications and academical degrees, and accompanied by copies of three recent testimonials, should be addressed, in envelopes endorsed "Deputy Chief Engineer," to Mr. Henry E. Stilgoe, M. Inst. C.E., the Chief Engineer, and must reach the Offices of the Board not later than the 21st July, 1930.

Canvassing will be held to be a disqualification.

G. F. STRINGER,
Clerk of the Board.

Offices of the Board,
173, Rosebery-avenue, E.C. 1,
28th June, 1930.

5312

PUBLIC NOTICES

Metropolitan Water Board. APPOINTMENT OF ASSISTANT ENGINEERING SUPERINTENDENT OF WORKS.

The Metropolitan Water Board invite APPLICATIONS from Resident Engineers, Civil Engineering Contractors' Agents and others in respect of the APPOINTMENT of an ASSISTANT ENGINEERING SUPERINTENDENT OF WORKS in the Chief Engineer's Department, at a salary of £350 per annum.

Applicants must have had experience in the control of workmen and in the laying of water mains and communication pipes in streets. The successful candidate will be required to devote his whole time to the service of the Board; to reside in either Brentford, Ealing or Twickenham, in which area the vacancy exists; to pass satisfactorily a medical examination by the Board's Chief Medical Officer; and to undertake in writing to join the Board's Superannuation and Provident Fund.

Applications, in the candidates' own handwriting, stating age and full particulars of education, training and qualifications, should be addressed to Mr. Henry E. Stilgoe, M. Inst. C.E., the Chief Engineer, and must reach the offices of the Board not later than the 21st July, 1930.

Canvassing will be held to be a disqualification.

G. F. STRINGER,
Clerk of the Board.

Offices of the Board,
173, Rosebery-avenue, E.C. 1,
1st July, 1930.

5336

New Forest Rural District COUNCIL.

SUGGESTED DRAINAGE SCHEME IN THE CIVIL PARISH OF ELING.

The above-named Council REQUIRE the SERVICES of a qualified ENGINEER to prepare a Sewerage Scheme for such parts of the civil parish of Eling as the Council may consider necessary to sewer at present.

It is hoped to obtain a grant for the scheme, when approved, from the Unemployment Grants Committee.

Sealed applications, marked "Appointment of Engineer," stating previous experience, terms for advising the Council, preparing reports, &c., for the approval of the Ministry of Health, Unemployment Grants Committee, and, if approved, the preparation of working drawings, &c., estimates, obtaining Tenders and carrying out the scheme in a satisfactory manner, to reach me not later than 10 a.m., Monday, 21st July, 1930.

By Order of the Council,
T. E. SMITH,
Clerk to the Council.

Council Offices,
Lyndhurst, Hants,
7th July, 1930.

5376

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED AT ONCE on N.E. Coast, RESIDENT CIVIL ENGINEER, A.M.I.C.E., for about 12 months, with experience in Piling, Reinforced Concrete, &c.—Write, stating age, salary and experience, P50, The Engineer Office. P50 A

WANTED by Old-established English Company in Valparaiso, YOUNG ENGINEER (B.Sc. Eng'g., or Assoc. M. Inst. C.E.), under 30 and unmarried, with experience in modern Treatment of Sewage. Salary, £575 per annum. First-class passage paid.—Write to T. A., c.o. J. W. Vickers and Co., Ltd., 24, Austin Friars, E.C. 2. 5374 A

WANTED for India, an Experienced STEEL MELTER for Electric Steel Furnaces. Candidates must have had at least five years' experience in actual charge of steel furnaces of the Heroult type and be competent to take sole charge when required. Experience in the Manufacture of Nickel Manganese and Nickel Chrome Steels is desirable, but not essential. Salary Rs. 500, rising to Rs. 600 per month. Three years' agreement.

Apply, No. 901, "Advertiser," Dundee. 5393 A

SITUATIONS OPEN (continued)

WANTED IMMEDIATELY, THREE Energetic YOUNG MEN, age about 26, good education and training essential, to Assist in Works Production in an Engineering Shop in the Midlands.—Address, 5352, The Engineer Office. 5352 A

ADDITIONAL TUTOR REQUIRED for Engineering Subjects, high qualifications essential. Residence in Oxford unnecessary.—Apply with recent testimonials, stating qualifications, OXFORD CORRESPONDENCE COLLEGE, Beaumont House, Oxford. P40 A

APPLICATIONS are INVITED for the POSITION of CONTRACTOR'S ASSISTANT (age 24-28) for Supervision Work on a Dock Contract in the Far East. Only those who have had such experience need apply.—Address, stating experience and when available, 5389, The Engineer Office. 5389 A

ASSISTANT ENGINEER REQUIRED by Firm of Reinforced Concrete Specialists. Must have experience in Designing.—Address, P64, The Engineer Office. P64 A

CIVIL ENGINEER, University Graduate, REQUIRED to Take Charge of the Construction and Maintenance of Roads, Railways, etc., in large Industrial Establishment. State age, experience and qualifications.—Address, 5383, The Engineer Office. 5383 A

CIVIL ENGINEER WANTED for Contract in Thames District, experienced in Accurate Setting-out of Works with Surveying Instruments and a knowledge of Pile Driving, Reinforced Concrete Construction and Quantity Surveying.—Give details of experience and salary required, to Z.W. 237, c.o. Deacon's Advertising Agency, Fenchurch-avenue, E.C. 3. 5375 A

ENGINEERING FIRM, with Offices in London, having first-class connection with shipping companies, public works contractors, and general engineers in the London district, are OPEN to ACCEPT AGENCIES where technical as well as selling experience is required.—Address, P54, The Engineer Office. P54 A

ESTIMATOR.—Reliable ESTIMATING ENGINEER for Foundry and General Engineering Contracting Work REQUIRED by old-established Engineering Business in Midlands; must be able, if necessary, to Take Charge of Outside Contracts. State fully age, experience and salary.—Address, 5377, The Engineer Office. 5377 A

ENGINEER REQUIRED for Fertiliser Factory (London); able to Control Maintenance Department and prepare own drawings when necessary.—Write, stating age, qualifications, &c., and salary expected, P39, The Engineer Office. P39 A

ENGINEERING FIRM, London, Specialising Structural Steel Work, Elevators, Conveyors, have VACANCY for experienced SALESMAN. Established connection essential. Commencing salary about £400. Applicant must be capable engineer.—Address, giving full particulars, 5390, The Engineer Office. 5390 A

GEAR CUTTING EXPERT WANTED, to Take Charge of Department in Commercial Vehicle Factory, to control production methods and machines. Must have first-class experience in work of the highest standard and familiar with every aspect of the subject.
Address, P62, The Engineer Office. P62 A

GENERAL ENGINEERS, London, REQUIRE capable WORKS MANAGER. Must be thoroughly conversant Works Costs, possess organising ability, and be able take full control, develop business.—Address, giving experience, salary required, 5391, The Engineer Office. 5391 A

MECHANICAL ENGINEER as ASSISTANT MANAGER to Engineering Company in Calcutta. Age about 35, experience in Locomotive Practice and Manufacturing necessary. Applicants please state full particulars, school, degree, diploma, practical experience, with copies of references. Position suitable married man, excellent prospects leading to Directorship.—Address, 5331, The Engineer Office. 5331 A

PLANNING ENGINEER REQUIRED for Large Automobile Works in Birmingham. Applicant must be fully experienced in either Sheet Metal or Machine Shop Work.—Address, 5340, The Engineer Office. 5340 A

RATEFIXER REQUIRED for Motor Car Works in Birmingham; man preferred who has been in charge and used to Time Study Methods.—Address, 5341, The Engineer Office. 5341 A

REQUIRED for West of England, ONE or TWO young active CONTRACTORS' ENGINEERS, with experience in Sewerage and Waterworks Construction. Must be competent setting out, able to prepare and measure for certificates, costs, &c. Knowledge of Tunnel Work desirable.—Apply by letter only, stating experience, references, salary required, to INDUSTRIAL CONSTRUCTIONS, Ltd., 54, Victoria-street, Westminster, S.W. 1. 5392 A

REQUIRED, GENERAL MANAGER for Group of Works engaged in the Manufacture of Textile Machinery; must be highly experienced and capable of Taking Full Control of all Departments.—Applications, with full particulars of past experience, to be addressed to R. W. WICKHAM, Esq., Fairbairn Lawson Combe Barbour, Ltd., Hope Foundry, Leeds. 5359 A

FACTORY MANAGER FOR PERMANENT POST IN GREAT BRITAIN.

Age 30-36. Education: B.Sc. standard.

At least four years' experience in managerial work with a progressive manufacturing company is necessary. Present salary should approximate £1000 per year.

Candidates in replying should give details of past experience, &c., and be in a position to supply highest personal references.

Address, P7192, The Engineer Office. P7192 A

WANTED, First-class DRAUGHTSMAN, with recent experience in Design of Centrifugal and Turbine Pumps.—Apply by letter, stating age, full particulars of experience and salary required, to CHIEF ENGINEER, Tangyes Limited, Cornwall Works, Birmingham. 5385 A

DRAUGHTSMAN.—AVELING and PORTER, Ltd., Rochester, REQUIRE the SERVICES of an Experienced DRAUGHTSMAN. Applications should state age, experience and salary required.—Address, 5330, The Engineer Office. 5330 A

DRAUGHTSMAN.—Capable WOOD WORKING MACHINE DESIGNER REQUIRED. Preference will be given to applicants with experience of Integral Motor Drives.—Address, stating age, experience and salary required, P18, The Engineer Office. P18 A

DRAUGHTSMEN REQUIRED IMMEDIATELY. Fully experienced Jig and Tool Designers. Only men having first-class experience of Jigs, Tools and Production Equipment for Automobile Work will be considered.
State age and give full particulars of qualifications.
HENRY FORD and SON, Ltd., Cork, Ireland. 5321 A

DRAUGHTSMEN REQUIRED IMMEDIATELY. Must be accustomed to modern Automobile Plant Layout and Installation. Also have some experience in Light Steel Structures and Pipework. State age and experience.—HENRY FORD and SON, Ltd., Cork, Ireland. 5322 A

DRAUGHTSMAN WANTED, Experienced in Designing Internal Combustion Engines.—ATLANTIC ENGINE CO., Wishaw, Scotland. 5368 A

For continuation of Small Advertisements see page 4.

A Seven-Day Journal

Empire Trade and the Banks.

AT a meeting held at Hambro's Bank on Wednesday, July 2nd, the following resolution was adopted: "It is resolved that urgent measures for the promotion of inter-Imperial trade are needed to secure and extend the market for British products, both at home and through the export trade. Bitter experience has taught Great Britain that the hopes expressed four years ago in a plea for the removal of the restrictions upon European trade have failed to be realised. The restrictions have been materially increased, and the sale of surplus foreign products in the British market has steadily grown. While we retain the hope of an ultimate extension of the area of free trade throughout the world, we believe that the immediate step for securing and extending the market for British goods lies in reciprocal trade agreements between the nations constituting the British Empire. As a condition of securing these agreements, Great Britain must retain her open market for all-Empire products, while being prepared to impose duties on all imports from all other countries." It was officially announced that the following were present at the meeting:—Sir Eric Hambro (Hambro's Bank), Mr. Walter Whigham (Bank of England), Sir Herbert Lawrence (Glyn's Bank), Sir Harry Goschen (the National Provincial Bank), Mr. R. H. Tennant (the Westminster Bank), Sir George May (the Prudential Assurance Company), Lord Ashfield, Mr. E. R. Peacock (Baring Brothers, Ltd.), Mr. Beaumont Pease (Lloyd's), Mr. Vivian Hugh Smith (the Morgan Grenfell Company), Lord Glenconner, Sir Alan Anderson, Mr. Reginald McKenna, Sir Harold Snagge, and Lord Bearsted.

New Electrified Lines on the Southern Railway.

THREE new extensions to the Southern Railway Company's electrified lines were put into service on Sunday, July 6th, and demonstration runs were made on Monday. They bring the total track mileage of the electrified lines up to 800, and practically complete the electrification of the whole of the company's suburban area. The new electric services are from Twickenham and Hounslow to Windsor, from Wimbledon to West Croydon, and from Dartford to Gravesend. Of the three extensions, that from Twickenham and Hounslow to Windsor is the longest and most costly. Its length is 27½ miles and the cost was £367,000. The extension from Dartford to Gravesend is 14 miles long and has cost £160,000; whilst that from Wimbledon to West Croydon is 8 miles long and its cost was £73,000. Further extensions of the electric system in hand, to be made at an estimated cost of £2,700,000, include Coulsdon to Brighton and West Worthing. Speaking at a luncheon at Waterloo Station on Monday last, Brigadier-General the Hon. Everard Baring, chairman of the Southern Railway, referred to the fact that the company had abolished the alternating-current system and had adopted direct current as standard on all its electrified lines.

Nottingham University College.

ON Wednesday afternoon last, July 9th, Brigadier-General G. M. Jackson, D.L., formally opened the new engineering laboratories at University Park, Nottingham. A large company was present, including the Chairman and members of the Council, with the Principal and the Senate. Although some of the engineering laboratories are still in use at the old University College in Shakespeare-street, a beginning has been made upon the transference of certain of the laboratories to the new buildings at University Park, which have been generously provided by Lord Trent, who perhaps is better known as Sir Jesse Boot. The new laboratories include a boiler-house and a heat engine laboratory, and an electrical power-house in which the transformer sub-station of the Nottingham Electricity Department is housed. A further block of buildings which is now being utilised as a workshop for the building operations, will shortly be available for laboratory use, and in due course other laboratories will be constructed at University Park, and the whole of the engineering work transferred there. The laboratories newly opened have been well equipped in response to an appeal for funds, plant and apparatus, and in this matter an advisory committee of local engineers has given valuable assistance. In our next issue we hope to describe the new laboratories and their equipment.

The Load Line Conference.

THE International Load Line Conference which began on May 20th concluded its sittings on the afternoon of Saturday last, July 5th, when an International Load Line Convention was adopted and signed by the representatives of twenty-seven Governments. The President of the Conference, Admiral of the Fleet Sir Henry F. Oliver, proposed the adoption of the Convention, and in his address summarised the results of the Conference, referring to the rules of the British Load Line Committee of 1927–1929, which had served well as a basis for discussion. The conclusions which had been arrived at are embodied in the rules of the new Convention, which are to be applied in full to all new ships, the keels of which are laid on and after July 1st, 1932. For those existing ships which are not brought voluntarily under the new rules, the rules of 1906, subject to effective measures being taken for the effective closing of openings in the weather decks and the sides of the ship for the protection of the crew, are to be imposed. Each nation ratifying the Convention will be bound to take steps to make effective the load lines prescribed by the rules. The President of the Board of Trade, who welcomed the members of the Conference some six weeks ago, congratulated them on the successful accomplishment of the task they had undertaken.

The Late John Edward Waller.

ON July 5th Mr. John Edward Waller, at one time senior partner in the firm of Kincaid, Waller, Manville and Dawson, of Westminster, died at the age of seventy-four years. Mr. Waller had a distinguished career as a consulting engineer for railways and harbours. He was the son of Dr. J. F. Waller, Barrister-at-Law, of Dublin, and received his professional training under Mr. William Baker, M. Inst. C.E., at one time Chief Engineer of the London and North-Western Railway. Between the years 1878 and 1882 he was resident engineer on the construction of the Roade to Northampton Railway and on the reconstruction of Rugby Station. He then occupied for a few months the position of Chief Assistant Engineer on the Rohilkund and Kumaon Railway in India. Taking up private practice, he became Chief Assistant to Mr. Joseph Kincaid in 1895, and in 1892 entered into partnership with Mr., now Sir Edward, Manville. In the following year these three engineers became partners, and in 1902 were joined by Sir Philip Dawson. The principal works upon which Mr. Waller was engaged were the South Yorkshire Junction Railway, connecting Denaby Main Colliery with the Hull and Barnsley Railway; a railway from the Nile Valley across the Libyan Desert to the Great Oasis; and one from the Burma Main Line to Bawdwin in the Northern Shan States. He constructed a pier, 4000ft. long, in Puerto, Columbia, in 1891, and extended it by 300ft. in 1914. He was also engaged upon many electric tramway schemes and was employed in Parliamentary, Board of Trade, and Light Railway affairs and arbitrations. He was elected an Associate Member of the Institution of Civil Engineers in 1882, and became a full member in 1891. In 1924 he retired from the firm with which he had been connected for nearly forty years.

Cranes in the Building Trades.

ARISING out of the disturbing number of accidents in connection with cranes employed for the construction and repair of buildings, the Factory Department of the Home Office has recently discussed with crane makers and building trade employers' and workers' associations the question of amending certain sections of the Building Regulations, 1926. As an outcome of several conferences, it was decided that the existing code as it affects cranes and other lifting appliances required to be substantially strengthened. The Home Secretary has now issued a draft of the amending regulations which he proposes to make. He is open to receive objections to the proposed regulations up to the end of this month. In the Draft Code it is specified that the working gear and anchoring appliances of every crane, &c., shall be inspected once a week by some competent person, and the results of the examination entered in a prescribed register. Every crane manufactured after June 31st, 1931, is to conform to the standards of strength, stability and safety specified in British Standard Specification No. 327 of 1928. No crane made before July 1st, 1931, is to be used after June 30th, 1935, unless it has been brought up to the standard laid down in the above-named specification. It is further proposed to forbid the employment after December 31st, 1930, of any crane embodying timber in its structural parts, unless it is examined and certified by a competent person at least once every fourteen months, and to forbid the employment of any such crane altogether after December 31st, 1939. Every crane after erection on a building site is to be tested for anchorage with a load 25 per cent. in excess of the maximum load to be lifted by the crane. There are numerous other detailed regulations in the suggested code with which manufacturers and users of cranes will have to make themselves acquainted.

Wessex Aircraft for Belgian Airlines.

THAT there is plenty of scope for the sale of British aircraft abroad has just been demonstrated by the Westland Aircraft Works of Yeovil, which have obtained an order for four Westland Wessex six-seater cabin monoplanes, from the "Sabena" air line operating in Belgium and the Belgian Congo. This contract was gained in the face of considerable competition, both from foreign and British manufacturers of similar types, who in all cases were offering their machines at a lower figure than that which the Westland Aircraft Works were prepared to accept. On July 2nd, the occasion of a visit to Yeovil by members of the Institution of Mechanical Engineers, Monsieur Cocquyt, of Sabena Transport, took delivery of the first machine from the Westland aerodrome. Before departure, Monsieur Cocquyt carried out a series of test flights. Mr. Gaunt, of the Westland Works service department, proceeded to Brussels with Monsieur Cocquyt in order to explain any technical points which might arise to the engineering department of Sabena Airlines. The Westland Company claims that the Wessex machine with its three 105–110 Genet Major engines, is the smoothest running aircraft of its type yet produced. Four passengers are accommodated in the cabin. A heating and cooling system enables them to travel in whatever temperature they require, regardless of the time of the year. The lay-out of the machine permits easy communication with the pilot and rapid exit in the case of emergency. The designers have also specially considered the comfort of the pilot, knowing that it reflects upon the safety of the passengers, by the installation of a form of rudder bias gear, which enables him to fly on a straight course on any two engines without becoming in the least tired.

A Ballot of Industry.

AT a meeting of the Grand Council of the Federation of British Industries, on Wednesday last, the following resolution was adopted:—"In view of the special responsibility attaching to industrialists in regard to employment, and the Federation of British Industries being the only body representative of British industry as a whole, it is resolved that a Committee, consisting of the President and Past Presidents, be appointed, with instructions to take such steps as they may consider best in order to ascertain the views of members, as to whether or not a more general application of safeguarding duties would contribute materially to the restoration of prosperity to British industry, and a consequent alleviation of the unemployment problem. That they further be instructed to ascertain the views of members in regard to the adoption of such a fiscal policy by this country as will permit of a wide extension of the policy of reciprocal agreements between the United Kingdom and the Dominions on the basis of mutual preference in their respective markets. It is further resolved that the special Committee, having taken into consideration the views of the members so ascertained, shall submit a definite recommendation for the final consideration of the Grand Council at a special meeting to be convened for the purpose of deciding the policy to be adopted by the Federation of British Industries."

Electricity in Bermondsey.

ON Monday last a conference of business firms in Bermondsey was held to protest against the price charged by the Bermondsey Borough Council for electric power. Several speakers said that if the price of electricity was not revised they would have to move their works to a district where the charges were more reasonable. Two resolutions were also passed, one requesting an inquiry into the affairs of the borough electricity undertaking by a competent Government body with a view to ascertaining if the present rate charged to industrial users was justified. The other resolution, which was sent to the Bermondsey Borough Council, protested against the extortionate charges, and requested that the rate should be made comparable with that of other supply authorities in the metropolitan area. One of the speakers explained that he had been forced to close one of his departments as he was unable to compete with factories in other parts of London.

French Railway Celebration.

THE centenary of the opening of the railway between Paris and St. Germain will not take place before 1937, but the French associations of commercial travellers and railwaymen decided to commemorate the event in their own way by a journey in what it was hoped would have been one of the original trains with a Buddicom locomotive. When the train pulled into the Gare St. Lazare on Sunday morning, the illusion was complete. It was a picturesque affair, and the driver, fireman and guard in uniforms of the period and passengers attired in the fashions of a century ago, conveyed a good idea of the conditions of travel in the late 'thirties. The first-class coach was one of the old vehicles which ran down to within quite recent times, and its archaic appearance showed how little change was made in the rolling stock during the existence of the Ouest Company. In the second-class coach the passengers were enclosed by wire netting, and the third-class vehicle was a truck. Outwardly, the vehicles were an exact reproduction of the first train, but it was noticed that the first and second-class coaches were fitted for steam heating. The locomotive presented an ancient appearance, and looked what it was intended to be, but the Westinghouse brake and the recollection of similar locomotives running in the 'eighties destroyed the illusion. Nevertheless, it was a successful celebration, although it was more picturesque than historical.

TILBURY PASSENGER LANDING STAGE

SIR FREDERICK PALMER, K.C.M.G., C.I.E., P.P. INST. C.E., WESTMINSTER, ENGINEER

FIG. 1—AERIAL VIEW OF LANDING STAGE, CUSTOMS HOUSE AND RAILWAY STATION

Tilbury Passenger Landing Stage.

As we announced at the time, the new Passenger Landing Stage at Tilbury, which has been constructed by the Port of London Authority, was formally opened by the Prime Minister on Friday, May 16th last. This landing stage forms part of the extensive series of improvements to the Port on which the Authority has been engaged practically ever since it took over control in 1909, and which, up to the present time, has involved an expenditure in respect of large works of about £16,000,000.

Before the landing stage was put into service, it was necessary to convey the passengers disembarking or embarking at Tilbury, by tender from ship to shore or *vice versâ*. Now, any of the vessels visiting the Port can lie alongside the stage at any state of the tide, with the result that much inconvenience and loss of time are avoided.

In view of the facts that the number of passengers using the Port is continually on the increase—the total reached in 1929 was over 306,000—and that no centralised facilities existed for their convenience, the Authority in co-operation with the then Midland Railway Company—now part of the London, Midland and Scottish Railway—promoted a Bill in Parliament seeking powers to construct a passenger landing stage in the river at Tilbury and to carry out ancillary works. The necessary powers were forthcoming by the passing of the Port of London and Midland Railway Act of 1922. Tilbury was chosen as it was considered to afford the most suitable site for the purpose. In the first place, there was already on the shore side a rail head having excellent railway connections with the Metropolis and all parts of the country. Then, too, the largest liners can navigate and berth in the river off the town.

The stage scheme was designed and executed under the direction of the Authority's Consulting Engineer, Mr. Frederick Palmer, C.I.E., P.P. Inst. C.E.—who has recently been created K.C.M.G.—and who, it will be remembered was, formerly, Chief Engineer to the Authority, and is now a partner in the firm of Rendel, Palmer and Tritton, of Westminster.

The stage, which is carried on sixty-three pontoons, has a total length over the end pontoons of 1131ft., and an overall length, including the fenders, of 1142ft., with a width of 80ft. The pontoons, which are built up of mild steel plates, $\frac{5}{16}$in. thick in the sides, ends and decks, and $\frac{1}{4}$in. thick in the bottoms, are of two depths, 4ft. 4in. and 7ft., and three lengths, 80ft., 90ft., and 100ft., the deeper and longer structures being employed in places where the weight imposed on the stage by the bridges and booms is heaviest. All the pontoons are 15ft. wide, and they are arranged parallel with one another, at distances apart of 3ft., at right angles to the shore line. The riverward ends of all the pontoons are flush, while the other ends of the 90ft. and 100ft. pontoons project 10ft. and 20ft. respectively beyond the decking shorewards. All of the pontoons have a freeboard or reserve of buoyancy of 1ft. 4in. Linking all these pontoons together are five keelsons, which are arranged parallel with the shore line, that is to say, at right angles to the axes of the pontoons. The keelsons are

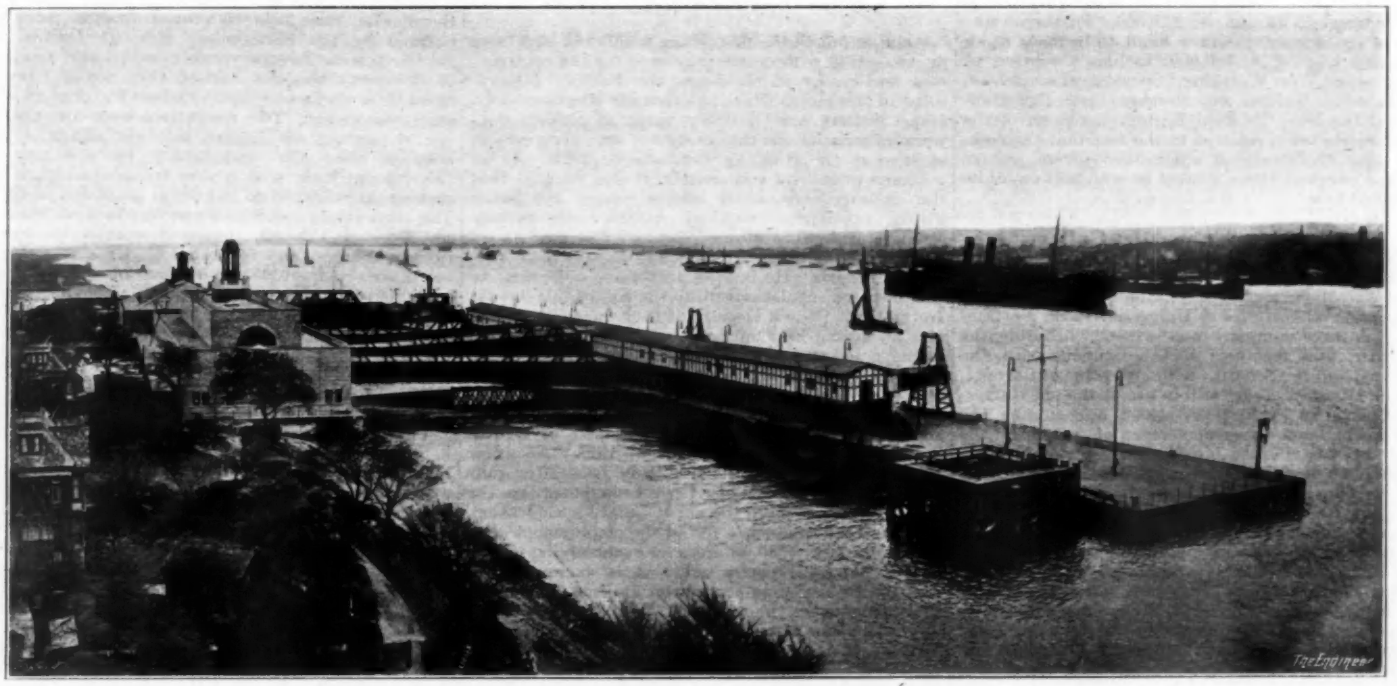
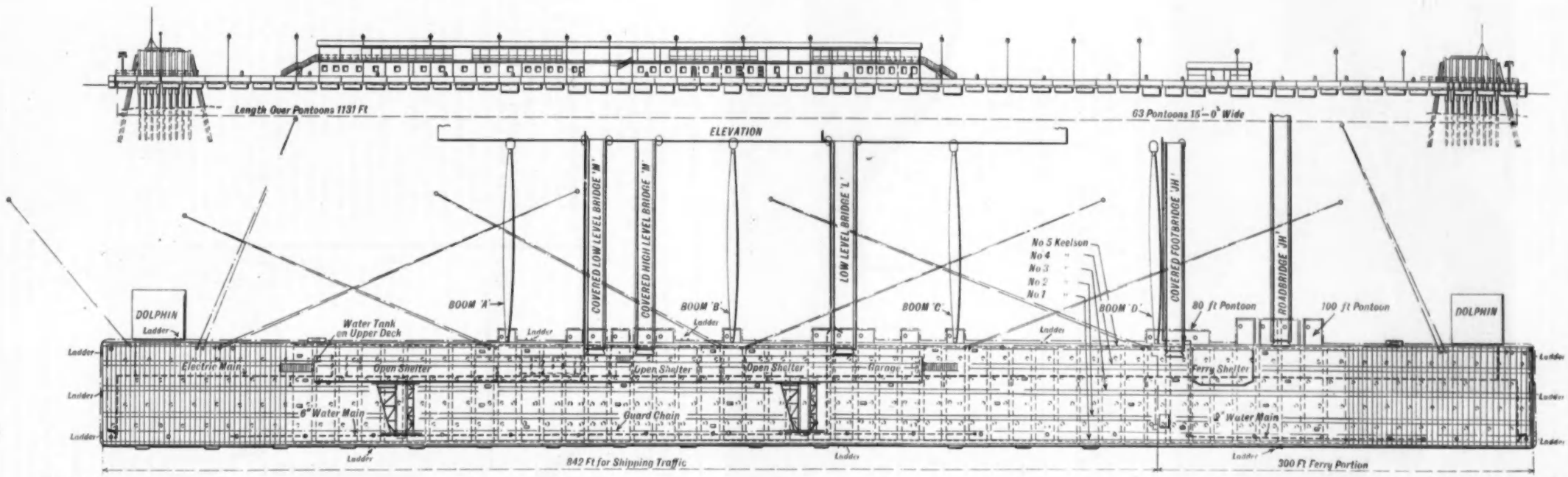


FIG. 2—GENERAL VIEW OF THE LANDING STAGE FROM UPSTREAM

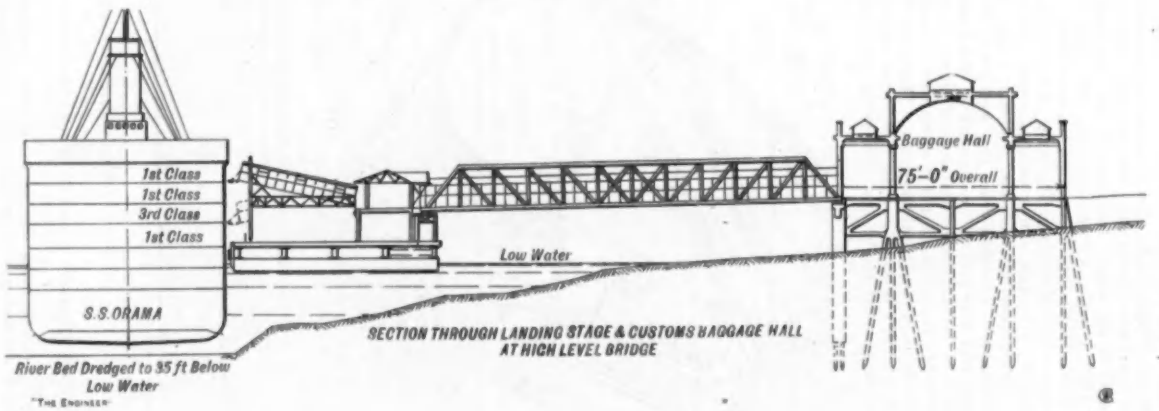
formed of a series of built-up box girders of uniform section throughout, 3ft. 7in. deep by 2ft. $4\frac{1}{2}$in. wide, bolted together, the majority of these girders being 54ft. long. One keelson is arranged on the centre line of the deck; the two immediately on either side of it have their centre lines 20ft. from that of the central keelson, while the two outer keelsons come at the outer and inner edges of the deck, and their centre lines are at a distance of 17ft. 6in. from those of the keelsons next to them. The decking, which is of Jarrah wood timbers set with open joints, is carried on 16in. by 6in. mild steel joists which are laid on and bolted to the keelsons at right angles to the latter.

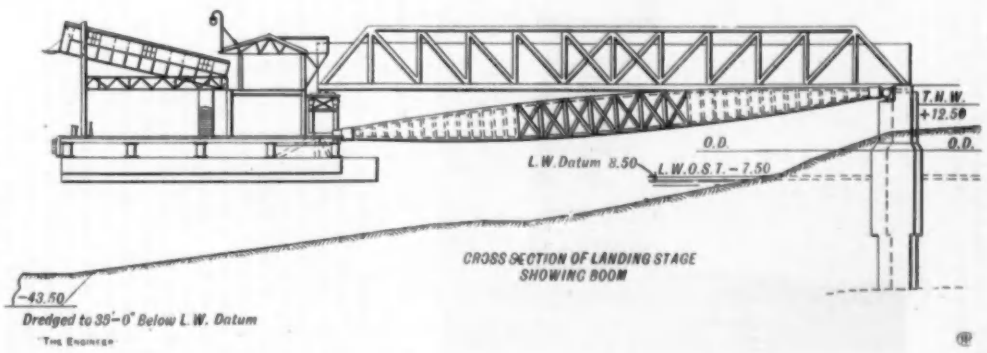
TILBURY PASSENGER LANDING STAGE

SIR FREDERICK PALMER, K.C.M.G., C.I.E., P.P. INST. C.E., WESTMINSTER, ENGINEER



PROFILE AND PLAN OF THE STAGE, SHOWING BOOMS AND MOORING CHAINS





The outer edge of the stage projects into the river for 370ft. from the original bank, which has now been furnished with an embankment, and the stage is held in position against two massive timber dolphins carried on piles, by means of four hinged booms and seventeen heavy mooring cables. The booms are lattice steel structures of the double bow-string type, both ends being plated-in so as to give them sufficient buoyancy to enable them to float. There are double hinges at each end of these booms, so that movement in all directions is possible. At the stage end the hinges are housed in a heavy crosshead, sliding between guides, which are fitted with a series of stops, that may shear under abnormal stresses due to collision, &c., so that damage to the structure is avoided. It was necessary, of course, that the ends of these booms should be jointed, and given free movement since the stage rises and falls, and has a tendency to move upstream and downstream with the tides. There is, in fact, a usual range of 21ft. during spring tides, while on exceptional tides that figure is sometimes exceeded. The up-river and down-river movement is, we understand, slight, but a maximum movement of 5ft. has been allowed for. The mooring chains are arranged at the angles indicated in the drawing on page 29, the inner end of each being connected to a pair of mooring screws driven into the foreshore.

Communication between the stage and the shore is effected by means of five bridges, three of which are for the liner services and covered in so that passengers are protected from the weather. These bridges, like the booms, are hinged at their ends. The base of the hinge is in the form of a slipper carried between two guides, so that it is capable of to-and-fro movement in a horizontal direction. The shore end of each bridge is anchored by means of a pivot. At the stage ends the bridges are furnished with let-down flaps to render access to them from the deck easy.

During construction the pontoons were assembled on the foreshore and were launched into the river down a temporary slipway. As a length of some 300ft. was completed, it was towed into its final position. The bridges and booms were also erected and completed on temporary staging in the river, being afterwards lifted and floated to the stage on pontoons. The three bridges provide ample means of communication for both passengers and baggage between the stage and the baggage hall and the circulating area in the railway station, to which reference will be made later. The fourth bridge, also covered, is for foot passengers, but will not be used by those coming from or going on to liners, while the fifth bridge provides a means of access to the stage for vehicular traffic, and to it we shall also refer again later.

For enabling the outgoing and incoming passengers to proceed from the staging to the ship or *vice versâ*, there are two travelling gantries running on rails. These gantries have a possible length of travel of nearly 500ft., so that they can readily be brought opposite the places on the liners at which passengers embark or disembark. To allow for different deck levels, these gantries have hinged covered foot-bridges, and we understand that these arrangements have proved very effective.

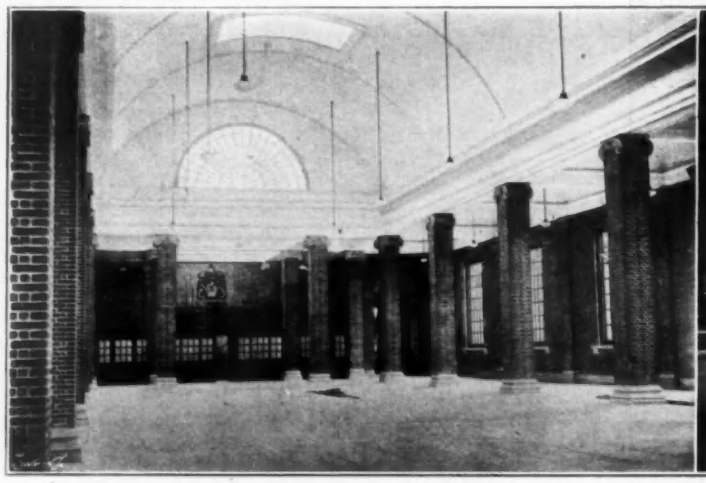


FIG. 3—CUSTOMS' HALL

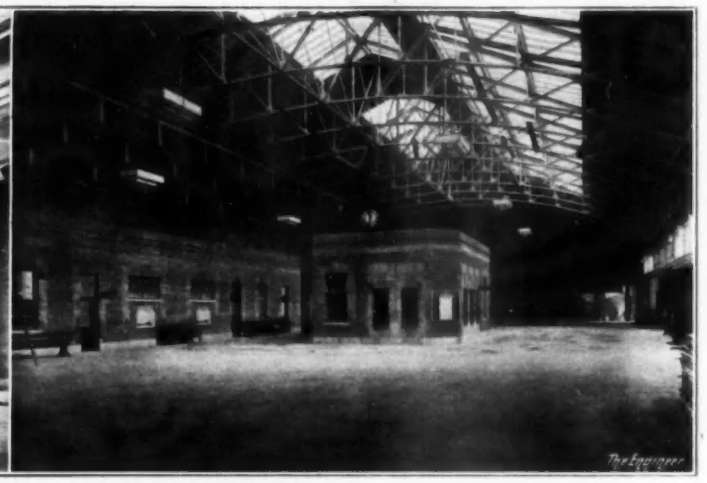


FIG. 4—CIRCULATING HALL IN RAILWAY STATION

FIG. 5—VIEW ALONG STAGE LOOKING UPSTREAM

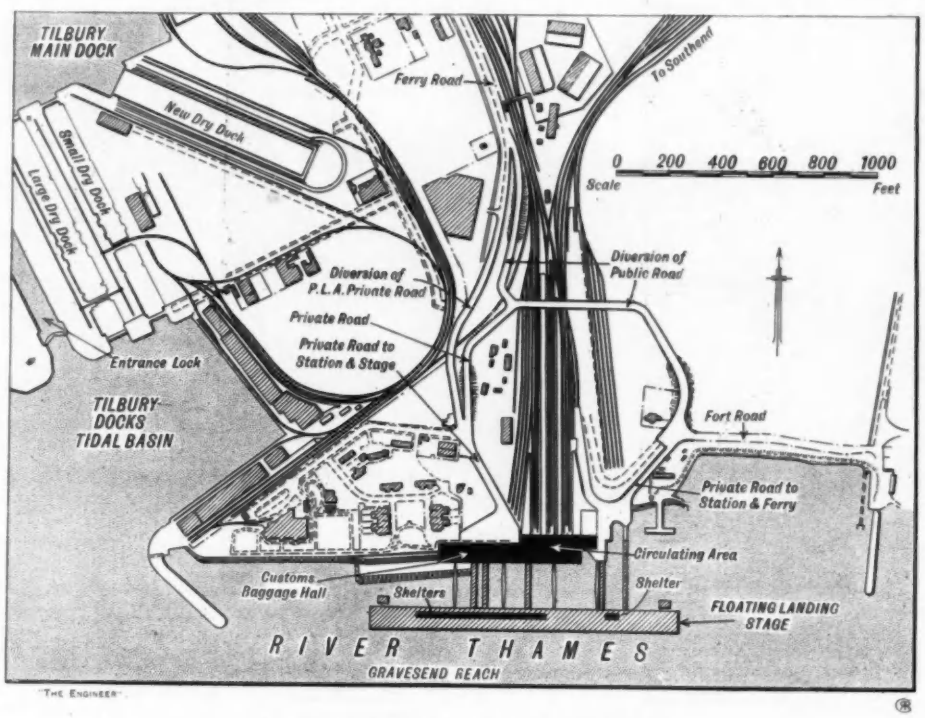


FIG. 6—GENERAL PLAN OF THE NEW WORKS

Before we proceed to describe the equipment of the stage, we may explain that the down-river end of the deck for a length of 300ft., is set apart for a cross-river ferry service which is maintained between Tilbury and Gravesend by the London, Midland and Scottish Railway. It is separated from the remainder of the deck by means of a barrier, and on it a convenient and commodious shelter is provided for ferry passengers. It is on to this portion of the stage that the fourth footbridge and the bridge for vehicular traffic lead. Its arrangement and position may be seen in several of our illustrations, while in Fig. 2 one of the ferry boats may be seen lying alongside the stage.

The portion of the stage devoted to liner services has erected on it a two-storey building in which there are waiting and examination rooms, shelters and other accommodation, the upper floor having a covered gangway which affords direct access to the vessels by means of the elevated gantries, to which reference has already been made.

Water for fire-protection and other purposes is brought on to the stage across two of the bridges by means of mains furnished with flexible joints, one main being 6in. and the other 2in. in diameter. Hydrants are fixed in various positions. For lighting and for operating the gantries, current is brought by a main running over a third bridge.

The scheme embodied the erection of an extensive baggage hall and the entire remodelling of the existing railway station. For these purposes it was necessary to construct a reinforced concrete platform 600ft. long over the foreshore of the river. As is well known, the ground in the neighbourhood of Tilbury is of an extraordinary character, and to obtain a stable foundation it is necessary to excavate to a great depth. Consequently, it was decided to erect this platform on piles. Concrete piles 65ft. in length were employed, the outer groups being encased in oval concrete cylinders and sunk to a depth of over 50ft. The hall, which was designed by the Authority's Consulting

Architect, Sir Edwin Cooper, A.R.A., F.R.I.B.A., measures 295ft. long by 72ft. wide, and 38ft. high. It is built of brick and the roof is of the barrel plaster type. As can be seen from Fig. 3, which shows a part of the hall, the building has been designed to give the maximum amount of light, and there is extensive space for the sorting of passengers' luggage. Benches are arranged down the centre to meet the requirements of the Customs' Officers. There is direct communication between this Hall and the new station of the Railway Company.

As has been said above, the scheme necessitated the complete remodelling of the railway station, and that part of the work has been done by the L.M.S. Railway Company. The original station buildings, the refreshment rooms and circulating area, as well as the bridge over a portion of Ferry-road, which was abandoned, were entirely demolished. A new and spacious circulating hall—see Fig. 4, which has been reproduced from a photograph courteously lent to us by the Company—as well as new booking-offices, refreshment rooms and other offices, have been provided. Additional lines have been laid, and the original platforms have been lengthened to accommodate long main line trains. The approach to the station has also been considerably improved by the diversion of Ferry-road over the railway, as may be gathered from the aerial view, Fig. 1. A plan showing the lay-out of the new station and its connections and its position relative to the landing stage is given in Fig. 6.

The whole of the works in connection with the landing stage and baggage hall were carried out under the Authority's New Works Engineer, Mr. F. W. Davis, M.Sc., M. Inst. C.E., as Resident Engineer, and to him our thanks are due for courteous assistance during the preparation of this article, and for the loan of certain of the photographs and drawings from which some of our illustrations have been reproduced. Mr. Davis was assisted by Mr. W. Mackenzie, M. Inst. C.E., and Mr. R. R. Liddell, M. Inst. C.E. We also desire to tender our thanks to the Authority for permission to publish this article and to Sir Frederick Palmer for the loan of the drawing showing the plan and profile of the stage. The contractor for the floating stage was the Cleveland Bridge and Engineering Company, Ltd., which fabricated all the steel works in the pontoons, girders, bridges and booms at its works at Darlington. The contractors for the embankment were Sir Robert McAlpine and Sons, while the baggage hall was built by John Mowlem and Co., Ltd.

The railway circulating hall and the remodelling of the station were designed and executed partly by contract and partly by administration by the Engineering Department of the London, Midland and Scottish Railway Company, under the direction of Mr. A. Newlands, M. Inst. C.E., the Chief Civil Engineer to the company. The contractors for the road diversion were Sir William Arrol and Co., Ltd., and for the circulating hall, John Mowlem and Co., Ltd.

The total cost of the works, including those carried out by the railway company, is, we understand, approximately £700,000. The Authority is receiving financial assistance from the Government through the Unemployment Grants Committee.

Institution of Mechanical Engineers.

No. II. (*conclusion*).*

WE continue below our account of some of the principal works visited by the members of the Institution of Mechanical Engineers during the summer meeting at Bristol last week.

W. SISSON AND CO., GLOUCESTER.

The works of this company are situated about 2 miles from Gloucester near the main Gloucester and London road, and adjoining the L.M.S. Derby and Bristol line, and were established in 1904, when the firm was incorporated as a limited liability company to take over the private company of the same name with works in Gloucester near the river and docks. The present establishment covers an area of over 3 acres. The buildings consist of five bays, each about 170ft. long by 30ft. wide, and a foundry for iron and brass, a mess-room for employees, garage, and pattern stores. The five main bays have roofs of weaving shed type, the stores, tool room, &c., are on the ground floor of the first bay, and the whole of the offices, drawing-office, and patternshop are on the first floor. The second and third bays contain the machine tools. The fourth and fifth are used for assembling and erecting engines and machinery. The test department for steam engines is at the end of the fourth bay adjoining the boiler-house, and is equipped with surface condensing plant, Froude dynamometer and absorption appliances for steam consumption, brake horse-power and electrical tests respectively. All the bays, except the first, have travelling cranes and electric pulley blocks. All machining is done under the Newall limit gauge system, and all parts pass through the inspection department on their way to assembly and erection.

The productions include vertical high-speed enclosed self-lubricated steam engines in sizes from a 2in. stroke single-cylinder splash-lubricated engine to a 12in. stroke double-cylinder forced-lubrication engine; enclosed, self-lubricated, twin-cylinder, reversible steam engines, completely dust-tight, for hoists and other similar purposes; marine type, open, compound, and triple-expansion engines, both fixed direction and reversible; marine screw and paddle engines up to about 600 I.H.P.; light-frame compound and triple-expansion marine screw engines for launches.

* No. I. appeared July 4th.

SPENCER (MELKSHAM), MELKSHAM.

The present works of the company were erected about twenty-five years ago, and occupy a site of about 11 acres bounded on one side by the Great Western Railway and on the other by the main road from Melksham to Chippenham. The drawing and tracing offices are on the first floor and provide accommodation for sixty draughtsmen and twenty tracers. They are connected through double fireproof doors with the pattern shop and joiners' department, and a fireproof drawing store and a photographic department are connected with the office.

The main shops consist of seven bays, each 50ft. span and 260ft. long. Of these, six form one large open shop containing machine tool, fitting, erecting and constructional steel departments, while the other, which is partitioned off by a brick wall, forms the principal moulding shop. In an annexe to the latter small machine moulding and brass casting is done. In addition to the main shops, and adjacent thereto, are a large template shop, a building for experimental and special work and the electrical and plating departments. The steel constructional yards are served by travelling steam cranes. The machine tools throughout the works are electrically driven by sectional motor drives, the current being obtained from a central generating station. The firm manufactures elevating and conveying plant for grain, coal, ore, cement, and other materials, and mechanical handling plant and labour-saving appliances. The average number of employees is about 600. Well-laid-out recreation grounds adjoin the works, including bowling green, tennis courts, &c.

BRISTOL CORPORATION ELECTRIC GENERATING STATION, PORTISHEAD.

The new generating station at Portishead has been erected to meet the anticipated demand of approximately 100,000 kW by the year 1938 in the Corporation's area of supply. The station is situated close to the river Severn, from which an unlimited supply of condenser cooling water is available, and adjoins the Great Western Railway and the Portishead Dock. The buildings are divided into a boiler-house, turbine-room, and low-potential switch-house, a separate building accommodating the high-potential switch-gear. The buildings stand in tiers down the hillside.

One of the features of the station is the novel arrangement of the condensers, the bottom of the pump pit being 54ft. below Ordnance Datum. The condensers are at Datum level, and the vertical-spindle pump motors just below the turbines well above the highest recorded tide level. The maximum range of tidal variation is 51½ft. The four culverts conveying water to the station are at such a depth as to maintain sufficient water over the top of their sea ends at the lowest recorded tide. The system has been designed to allow of the flow of water being reversed. The coal-handling installation consists of two travelling quay cranes, each of 60 tons per hour capacity, which deliver the coal into a receiving hopper operating in conjunction with a series of belt conveyors crossing the railway lines and delivering to drag link conveyors running over the bunkers in the boiler-house. Rail-borne coal is dealt with by two 20-ton side-discharge wagon tipplers and two bucket elevators. The ash-handling plant is composed of two lines of water sluicing troughs below the boiler-house basement floor, specially designed elevators, and belt conveyors. The electric motor control of the coal and ash-handling plant is interlocked throughout to ensure that each section of the handling equipment is started and stopped in correct sequence.

The steam-raising plant consists of four "Vickers Header" straight-tube boilers, each having a normal evaporative capacity of 80,000 lb. per hour at a working pressure of 325 lb. per square inch and a temperature of 725 deg. Fah. The stokers are 24ft. wide and are the widest now in commission in this country.

The two turbines of the two-cylinder impulse type are each of 20,550-kW maximum continuous rating, and a 550-kW non-condensing turbine set has been installed for emergency house-service duty. The main turbines operate at a steam pressure of 300 lb. per square inch gauge, and a total temperature of 700 deg. Fah. The condensers, which are installed in a pit 45ft. below the turbines, are of the central-flow type, and the high condensate temperature, approximating to that of the exhaust steam, de-aerates the condensate in the condenser itself. The system operates on a closed circuit; the condensate is withdrawn from the condenser by either one of two extraction pumps and delivered through two main and two auxiliary feed heaters to the boiler feed pumps. The main feed heaters are supplied with steam diverted from two low-pressure stages in the turbine, while the auxiliary heaters utilise exhaust steam from the steam-operated air ejectors and leakage steam from the high-pressure turbine gland respectively. The temperature of the condensate is thus raised from 80 deg. to 197 deg. Fah., with a corresponding gain in overall efficiency. A constant head is maintained on the system by a surge tank, which absorbs fluctuations in the output of the extraction pump and the demand of the boiler feed pump. Make-up water is added to the system from evaporators operating with sea water and supplied with steam diverted from a low-pressure stage of the turbines.

An alternator of 25,000-kVA capacity at 11,000 volts is directly connected to each turbine, and each generating set is connected to a bank of transformers stepping up to 33,000 volts. The main switchgear is of the metal-clad, compound filled, draw-out type, incorporating full interlocking features.

The station is being extended to accommodate two 50,000-kW turbo-alternator sets. For the purpose of the South-West of England and South Wales portion of the national "grid" scheme, Portishead is to be the most important seat of generation, the Central Electricity Board having scheduled the station as one to be used up to its installed capacity. Its development under the scheme is to be very rapid, as by the year 1943 the installed capacity will be not less than 240,000 kW.

GREAT WESTERN RAILWAY COMPANY, LOCOMOTIVE CARRIAGE AND WAGON WORKS, SWINDON.

The Swindon works comprise one of the largest railway establishments for the construction and repair of locomotives, carriages, and wagons in the world, and cover an area of 323 acres of which 72 acres are roofed. Power for the works is bought from the Corporation, whose new station has a capacity of 11,000 kW, of which the company takes about two-thirds. In addition to the construction and repair of locomotives, &c., a large amount of miscellaneous work is carried out for other departments of the railway—for example, the manufacture of castings and forgings for, and repairs to, pumping and hydraulic machinery. The total staff employed in the department of the Chief Mechanical Engineer exceeds 41,000, of whom over 12,000 are employed at Swindon.

The locomotive works are situated on the north side of the main line and include fitting, erecting, boiler-making, and machine shops, iron and brass foundries, smiths', stamping, tinsmiths', and coppersmiths' shops. The works have steadily increased in size, and in the last few years have been completely remodelled, whilst the equipment has also been improved. The "A" erecting and machine shop has an area of 503,000 square feet, and is planned for progressive operation of erecting, fitting and wheeling. It is divided into three sections—erecting shop, machine and fitting shop, and wheel shop. The annual capacity of the works is 1000 locomotives repaired and 100 new engines built.

To systematise the work and reduce the time occupied at the engine pits, all parts such as frames, cylinders, motion, &c., are prepared in the fitting shops and delivered practically ready for use to the erectors. The mechanical equipment of the older part of the shop includes two electric traversing tables serving eighty pits and four overhead electric travelling cranes of 50 tons capacity each. An electric traverser is also provided for taking engines in and out of the shop. The new portion was completed in 1921 for dealing with the largest engines. There are sixty pits, each 100ft. long, served by an electric traverser and four electric cranes, having a span of 75ft. and 100 tons capacity. With the new plant, about 400 large engines can be dealt with annually. An engine-testing plant is installed in the erecting shop, by means of which the draw-bar pull, water and fuel consumption can be determined under laboratory conditions at all speeds up to an equivalent train velocity of 70 miles per hour. An interesting feature in the boiler repair bay is a powerful hydraulic riveter having a 23ft. gap for dealing with long boiler barrels and large cylindrical tanks.

The machine and fitting shop is devoted to the repair and manufacture of parts, such as motion, connecting and coupling-rods, piston valves, solid and built-up cranks. A feature of its equipment is the grinding plant. The wheel shop is engaged solely on the turning, tireing, quartering, balancing, &c., of engine and tender wheels and deals with some 6000 pairs of wheels in a year. An interesting piece of apparatus installed in this shop is the wheel-balancing machine, by means of which adjustments can be made to wheels, so that in service they run smoothly and consequently lessen wear and tear.

The yearly output of the ironfoundry is between 20,000 and 25,000 tons of finished castings. The largest casting in one piece which has been produced in it weighed 65 tons. An interesting example of the moulder's art may be seen in the combined cylinder and saddle casting for a "King" class locomotive. The mould for this is in four separate parts, and there are twenty cores. The cylinder shop and machine shop are set apart for cylinders, frames, boiler foundation rings, smoke-box doors, &c. The equipment consists of boring mills, planing machines, radial drilling and tapping machines. The frames are slotted in batches up to ten on a special machine.

Other departments of the locomotive works of interest are the boiler shop, the new gasworks, the drop-stamping plant, the boiler-testing plant, in which steam at high pressure from a "master" boiler is admitted to the boiler under examination, the inspec-

tion, testing and research department, and the heat-treatment shop.

The carriage works are situated on the south side of the main line and the wagon works on the north-east side. The yearly output of the first-named department is 250 passenger vehicles of various types built and 5000 coaches repaired; the wagon works have a capacity for dealing with the construction of 4500 and the repair of 8000 wagons per annum. About 5300 men are employed in the works, which comprise the following shops:—Saw mill, new body, carriage body, repair, finishing, painting, polishing, trimming, wheel, lifting, stamping, electrical fitting, smiths', wagon frame, wagon repair, road wagon, oil and grease shops, and the laundry. The use of steel in carriage construction has necessitated a complete change in design and methods. The floors of coaches are of corrugated steel sheets filled in with fire-proof composition. The sides and roof are of sheet steel attached to a timber framework. The coaches are thus largely fireproof. Interiors are panelled in wood and upholstered in the usual way. In the finishing shop most of the interior woodwork is prepared. Such parts as doors, seat frames, panelling, luggage racks, and woodwork for electric lighting, are treated in the paint and polishing shops ready for assembly and erection in the coach bodies. The work of the trimming shop consists principally of upholstering of coaches, the manufacture of cushions, blinds, window straps, bedding, &c., and general leather work. The products of the fitting shop include the manufacture and repair of vacuum brakes, axle-boxes, self-contained buffers, regulating gear for auto-trains and trailer cars, draw gear, underframes for carriages and rail wagons, metal fittings for coaches, steam heating apparatus, gas lamps, &c. A complete system of jigs and templates enables work to be carried out rapidly and accurately.

The wheel shop has recently been re-equipped with modern machinery, for example, a double-ended machine for grinding the journals of carriage axles, machines for boring, facing, and turning wheel centres and wheel lathes with attachments for grinding the treads of worn and brake-hardened carriage wheels.

PETTERS, LTD., WESTLAND WORKS, YEOVIL.

The engine business of Messrs. Petters was founded in 1895, when the brothers Petter—Sir Ernest W. Petter, now chairman of the company, and Mr. P. W. Petter, vice-chairman—became interested in internal combustion engines, particularly with a view to their use for road carriage propulsion. Those were the days of the red flag signal, and the first car which they made in 1895 was only allowed to run without that safety precaution by special permission of the police between the hours of six and eight o'clock in the morning. This particular car was one of the first, if not the first, motor car with an internal combustion engine made in Great Britain. The manufacture of motor cars was continued for some time, but the business in stationary engines developed more rapidly, and ultimately the manufacture of motor cars was discontinued.

The business having outgrown the original Nautilus Works, a large site was purchased in 1912 on the outskirts of Yeovil, and the first buildings were erected on the land now known as the Westland Works. The whole site, which includes the aerodrome, exceeds 100 acres in extent, and the actual area covered by the buildings is approximately 10 acres. Up to 1910 engines of the four-stroke cycle type only had been manufactured, but in that year the first Petter two-stroke cycle engines were placed on the market, and in 1915 the directors were so convinced of the superiority of the two-stroke cycle that they determined to discontinue the manufacture of four-stroke cycle engines altogether.

The engines now manufactured are divided into three classes:—(1) Small engines with magneto ignition, made in sizes from 1½ to 5 H.P., largely used for agricultural work, pumping, &c.; (2) hot bulb, or, as they are preferably called, surface-ignition engines, in sizes from 5 to 36 H.P.—formerly engines of this type were always started with a blow lamp of the Swedish type, but in 1923 the patented method of cartridge ignition was introduced which considerably helped the development of the company's business—and (3) airless injection engines of the Diesel type, which are now being manufactured in sizes from 25 to 400 H.P., with from one to six cylinders. The heavy engine department in which the larger size engines are made was erected in 1928.

The Westland Aircraft Works, commenced in 1915, owed their inception to the demand for service machines in the war. The factory adjoins the engine works and has an extensive aerodrome immediately attached, enabling tests to be carried out with great facility. Numerous types of aircraft have been produced at these works, including "Westland Wagtails," "Weasels," and "Westburys," the "Wizard," the "Widgeon" for private owners, the "Westland Wessex" limousine for passenger work, the "Witch," a short-range day bomber, the "Westland Interception Fighter," &c. To-day quantity production is centred on the "Wapiti," a general-purpose war machine with "Bristol Jupiter" engine. Experimental work is being vigorously carried out on special types of machines, such as the "Pterodactyl," a tailless pusher monoplane, very original in design and possessing special features of controllability and unobstructed vision. About 2000 workers are employed at Westland in the engine and aircraft departments.

The Westland Aircraft Society, which is a branch of the Royal Aeronautical Society, is a very vigorous body, and during the session lectures on subjects of aeronautical interest are given by leading experts in the aeronautical world. Various sports clubs are in existence and part of the aerodrome is used by these. A well-equipped canteen is provided for the use of the workers, and there is a surgery with two trained nurses attached to the organisation.

The Royal Agricultural Show at Manchester.

No. II.*

AGRICULTURAL implement makers are still suffering from the prolonged depression in the farming industry, and the farmers' complaint is that labourers' wages are too high and hours too short. It is, therefore, all the more necessary for the farmer to make the utmost use of labour-saving machinery, and in this respect the tractor is capable of rendering great assistance, for there is scarcely an implement on the farm that cannot be operated with advantage by a good general purpose tractor, many types of which are now available at a moderate cost. In the early days of tractor working, when machines were heavier than at present, there was a well-founded objection to the tractor on the ground of soil compression, especially on wet clay lands. This objection now no longer exists, for the modern tractor is designed to exert no greater pressure per square inch than the horse.

The greatest advantage the tractor possesses over the horse is in the speed at which it does its work, making it easier for the farmer to complete his ploughing operations before the winter sets in. After ploughing, the work of tillage by the cultivator and harrow can be performed equally well with the aid of the tractor. Similarly, seed drilling can be carried on with much faster speed than is possible by means of horse traction, while for haymaking and harvesting the greater speed of the tractor is also an advantage. Mowing can be done, either using a cutter bar directly attached to the tractor, or by a mowing machine hauled behind it. In fact, the tractor need never be idle. After cutting and drying, the crop can be carried or stacked by its aid, while to take the produce to market a set of rubber tired wheels is a useful addition to the equipment, for this enables higher road speeds to be made with saving of time. When used for road haulage work it should not be forgotten that the tractor has to be licensed under the Road Locomotives Order and a tax of £6 per annum has to be paid. The utility of the tractor does not end here, however, for most machines can now be obtained with a belt pulley for operating all kinds of stationary machinery.

Agricultural tractors capable of performing most of the above functions are shown at Manchester by the Rushton Tractor Company, Ltd., of Walthamstow; the Société Anonyme Austin, Rue Lafayette, of Paris; Aveling and Porter, Ltd., of Rochester; Marshall, Sons and Co., Ltd., of Gainsborough; Massey-Harris, Ltd., of London; International Harvester Company of Great Britain, Ltd., of London; Ransomes, Sims and Jefferies, Ltd., of Ipswich; the Ford Motor Company, of Manchester; the Associated Manufacturers Company, Ltd., of London; and J. and H. McLaren, Ltd., of Leeds.

* No. I. appeared July 4th.

RUSTON AND HORNSBY.

The numerous exhibits of Ruston and Hornsby, Ltd., Lincoln, include a newly designed airless injection, cold-starting, horizontal oil engine; a high-speed vertical engine, for running on fuel oils with airless injection, and a new portable oil engine mounted on a steel undercarriage. For larger plants the three-cylinder vertical cold-starting engine of 64 brake horse-power is well adapted to the work of generating electricity. It is a four-cycle engine, which can be easily converted to run on natural, town's or suction gas. It is designed to start instantly from cold without a hot bulb or other external starting devices. A group of petrol-paraffin engines ranging in power from 2 B.H.P. to 7½ B.H.P. is shown as being specially suitable for many agricultural purposes. They are of simple and efficient design and are fitted with the Wico magneto, which is built to spark at low engine speeds, so that the engines can "idle" over long periods. The 7½ B.H.P. engine of this type is shown direct-coupled to a 4½ kW Ransome dynamo. Another small engine of 2½ B.H.P. drives a compressor of the vertical, single-stage water-cooled pattern. Pumps and pumping plants are represented by a selection of small centrifugal pumps designed for heads up to 50ft. and for outputs of 60 gallons per minute, pumps for lifts up to 70ft. and outputs of 2300 gallons per minute, and ram and diaphragm pumps. A road roller, driven by a heavy-oil engine of the high-compression class and a Thermax patented vertical boiler designed for a pressure of 120 lb. per square inch are also on view. The special features of this boiler are the rapid water circulation, all round accessibility, quick steaming and high evaporative capacity.

The engraving—Fig. 7—shows Ruston and Hornsby's newly designed airless injection cold-starting engine, which is built in sizes from 10 to 66 B.H.P. with a single cylinder, and from 76 to 132 B.H.P. with twin cylinders. It is of the four-cycle pattern and the fuel is injected by a positively driven type of pump with spill valve control actuated from the side shaft. The cylinder head is completely water-jacketed, and the cylinder jacket and bed-plate form one casting. On the design of the cylinder head the makers are to be complimented. It is secured to the bed-plate by long studs with easily accessible nuts. The studs pass through bosses and are not exposed to the corrosive action of the cooling water. The head is fitted with a cover to facilitate cleaning. The piston is long and of special cast iron and has a floating gudgeon pin, which is lubricated through a central hole drilled in the connecting-rod. Ring lubrication is provided on the crank shaft and side shaft, the gears for the latter being of the machine-cut spiral type enclosed in an oil bath. A mechanical lubricator provides a positive supply of oil to the liner, piston and the large and small end bearings of the connecting-rod. This lubricator is driven direct from the side shaft and works automatically with the starting and stopping of the engine. The atomiser is of a simple, but accessible pattern, and the fuel pump is actuated through a lever and cam on the side shaft, all the parts being enclosed and running in an oil bath. The governor is of the centrifugal type, and is gear-driven. By means of a wedge mechanism it regulates the quantity of fuel delivered to the cylinder in accordance with the load, so that there is an impulse at every stroke. The design presents several new features, which we hope to refer to specially in a later article.

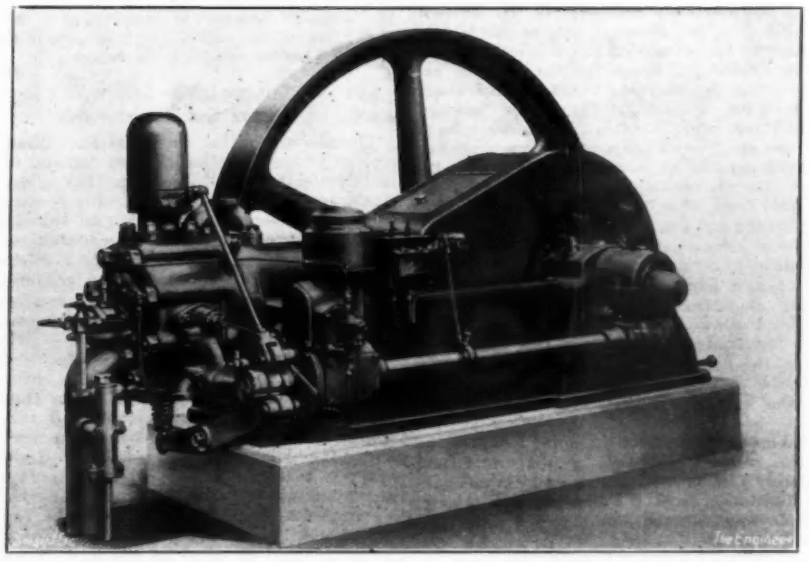


FIG. 7—AIRLESS INJECTION COLD-STARTING OIL ENGINE—RUSTON

GWYNNES AND FOSTERS.

Gwynnes Pumps, Ltd., in association with William Foster and Co., Ltd., Lincoln, is exhibiting several

centrifugal pumps, two of which are illustrated in Figs. 8 and 9. Fig. 8 represents a 6in., three-stage pressure pump coupled to a 100 brake horse-power motor on a common bed-plate. The motor is by Crompton Parkinson, Ltd., engineers. Fig. 9 shows a 6in. gravel pump, which is lined throughout with

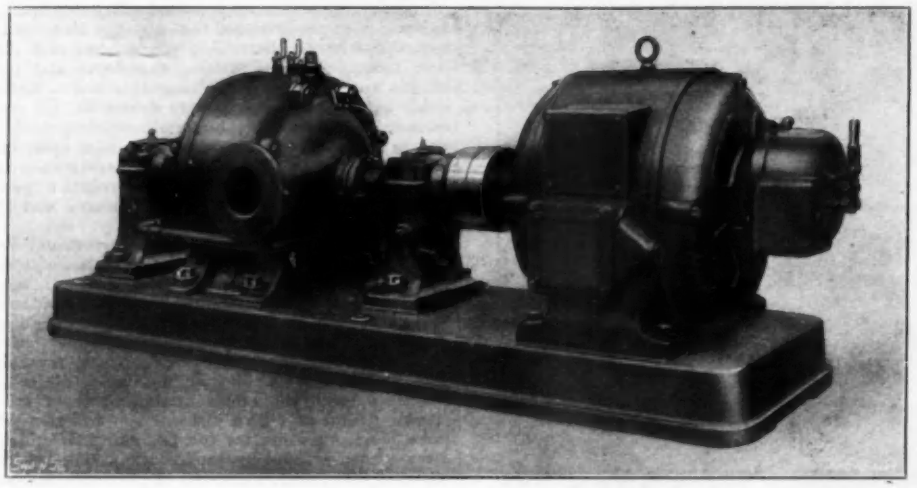


FIG. 8—THREE-STAGE MOTOR-DRIVEN PUMP—GWYNNES AND FOSTERS

manganese steel and is fitted with clean water service to prevent grit obtaining access to the neck bush. The impeller is of the single inlet, fullway pattern, and the out-of-balance load is taken by a Michell thrust bearing, which is water-cooled. Pumps of this type are used extensively in this country for the reclaiming of gravels, while they are also used abroad for reclaiming ores. They are built in sizes ranging from 4in. to 12in. and the capacity ranges from 15 to 300 tons of solids per hour. Another pump shown by this Lincoln firm is a 6in. centrifugal pump for medium lifts with a shrouded impeller hydraulically and mechanically balanced. This pump has water-sealed glands and ball bearings and the casing is split on the centre line, the lower casing containing both suction and delivery branches. The traction side of Messrs. Fosters' activities is represented by the latest design of 5-ton compound steam tractor, which is fitted with a third travelling speed and is mounted on rubber tires. With this engine the intermediate transmission shaft is linked up with the main axle, so that the two shafts rise and fall together, thus retaining the gears in constant mesh. The cylinders are 4½in. and 6¾in. in diameter, and although the continuous economical horse-power generated is 14, on emergency it can be increased to 22. Another feature of these engines is the method of spring suspension employed,

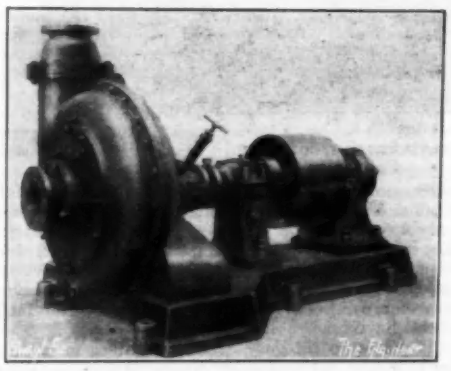


FIG. 9—GRAVEL PUMP—GWYNNES AND FOSTERS

by which the engine is supported from the axle-box bearings through the medium of two flexible laminated springs placed above the main axle and outside the horn plates. An 8 nominal horse-power single-cylinder agricultural engine and a 4ft. 6in. thrashing machine, with all the firm's latest improvements, are also exhibited.

BLACKSTONE.

We have selected the three vertical high-speed spring injection oil engines as forming one of the most attractive features on the stand of Blackstone and Co., Ltd., of Stamford. The largest of these engines has six cylinders and is direct coupled to a 35 kW Bull dynamo. The others are of the four-cylinder type, 36–40 B.H.P. engines, designed to run at 1000 revolutions per minute, one being fitted with a petrol engine as starter and the other with an electric starter. There are also to be seen single and twin-cylinder horizontal cold-starting oil engines of the spring injection type, and a 76 brake horse-power twin-cylinder engine is shown direct-coupled to a dynamo. This is running on load generating part of the current required for the A.G.E. stands. A number of paraffin engines with petrol starting from 1½ to 7 B.H.P. are shown which are familiar to our readers. In these engines the partial vacuum in the crank case prevents the throwing out of oil at the bearings. Close governing is another feature of the engine. It is accomplished by the automatic regulation of both the quantity and quality of the mixture fed to the combustion chamber.

DAIRY MACHINERY.

One of the most attractive exhibits in the dairy machinery section is a new milking plant shown by the Alfa-Laval Company, Ltd., Grosvenor-road, London, S.W. 1. In this milking machine the designer has not attempted to copy the manipulations of the human hand, but has adopted nature's method as exemplified by the sucking of the calf. In order to do this the milking pulse is not produced in each unit separately, but automatically and mechanically by the vacuum pump and from the pump to every unit in the plant. This involves the use of a small electric generator attached to the suction pump, and this creates the impulses which are transmitted to electro-magnetic pulse valves in the individual units, which produce the milking pulse. Suction is applied to the point of the teat only and not right up to the base of it, and the suction is completely cut off in the course of each pulsation. The transition between the suction and pressure impulses in the teat cups is instantaneously completed. The period of suction is applied only to a teat filled with milk and the period of release is timed so that the teat will be full of milk again when next the suction is applied. Another feature of the Alfa-Laval milker is that the milk is not drawn from all the teats simultaneously. By means of a neat contrivance, a piston in a casing immediately below the teats gives an alternating action. The pump is of the rotary type electrically driven, and the rotor and blades run in an oil bath. The cam which operates the contact breaker controlling the milking pulse is positively driven by gearing from the rotor shaft of the pump, so that when once set the timing cannot be altered. On each of the milk pails there is an operating cover which contains the magnetic pulse valve and check valve. The latter valve prevents any milk vapours which may have condensed in the main tube from contaminating the milk. It also maintains the vacuum in the pail and prevents the teat cups falling off should the pump cease working from any cause. The vacuum is controlled by means of an automatic valve, which admits screened air into the pipe line. From this brief description it will be gathered that the milk is drawn hermetically sealed, and as long as the apparatus is kept thoroughly clean, it is free from contamination of any kind. This machine has been awarded the Society's silver medal.

CROSSLEY BROTHERS.

The outstanding exhibit on Crossley Brothers' stand comprises a three-cylinder vertical compressorless heavy-oil engine with a direct-coupled 50 kW, 220-volt, direct-current dynamo running at 450 r.p.m. supplied by the General Electric Company. This type of engine has been described previously in our columns. Every working part is totally enclosed and supplied with forced lubrication. It is built in unit sizes having one to six cylinders, and with powers ranging from 27 to 330 B.H.P. These new enclosed vertical engines are designed to operate on the cheapest grades of fuel oil, and the guaranteed fuel consumption for the larger units is 0·39 lb. per B.H.P. hour. Although a totally enclosed engine, immediate access is afforded to all valves and sprayers by simply sliding backwards a light aluminium cover plate, which exposes the valve gear and the cylinder heads. The engine shown in Fig. 10 has exceptionally clean

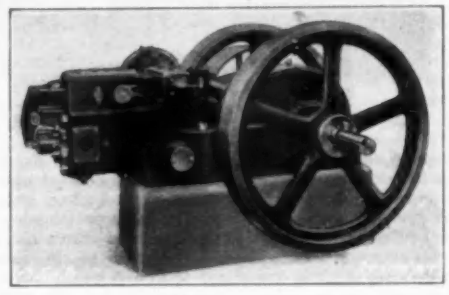


FIG. 11—CRUDE-OIL ENGINE—CROSSLEY

lines, giving it a very neat appearance and it runs very smoothly.

Two examples of Crossley enclosed horizontal crude-oil engines of 24 B.H.P. and 17½ B.H.P. respectively are also shown as working exhibits. The speeds are 375 r.p.m. and 500 r.p.m. for the larger and smaller engines. The engines are designed to operate on fuel oil, and all the moving parts are enclosed and protected and are supplied with automatic lubrication. Fig. 11 illustrates the general type. The principal features of design include a chain-driven cam shaft running in oil, and valves in detachable cages fitted in the cylinder head. The engines are arranged to start from cold by means of compressed air, which is obtained from a storage receiver, self-charged from the engine. The particular design of combustion chamber employed ensures a low fuel consumption and a clean exhaust.

Another working exhibit is a Crossley vertical

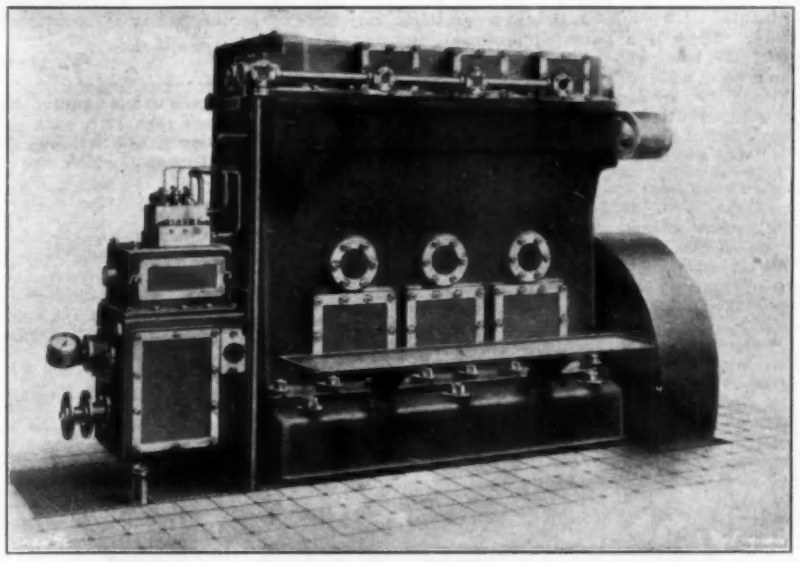


FIG. 10—50-kW THREE-CYLINDER OIL ENGINE—CROSSLEY

two-stroke engine with an output of 11 B.H.P. at 600 r.p.m. This engine has a separate scavenge pump—as opposed to crank chamber compression—so that it will utilise a range of heavy fuel oil with both cleanliness and economy. All the main moving parts are lubricated under pressure. Several Crossley small oil engines, hopper-cooled, horizontal, 2½–3½ and 7 B.H.P., are shown in operation. These motors utilise paraffin fuel and they are arranged to start up immediately by the use of a

very small quantity of petrol. Magneto ignition is fitted and they are totally enclosed, being dustproof and self-lubricated, so that they can run over long periods without special attention.

Crossley Brothers, Ltd., have a further exhibit worthy of special notice by owners of parks, in the

FIG. 12—BY-PASS FOR MOTOR VEHICLES—CROSSLEY

shape of a device to avoid the opening of gates. Motorists living in the country are frequently called upon to get out of their cars to open and close gates on private roads and drives. Messrs. Crossley's method of overcoming this trouble consists in making a gap about 8ft. wide in the fence close to the gate. In this gap a pit is dug about 4ft. deep and 6ft. wide and over this are placed two iron tracks, 2ft. wide, and having flanges on each side and rungs like those in an iron ladder. A by-pass is made to and from the tracks to connect with the road or drive round the gate. These tracks will carry a weight up to 3 tons with an ample margin of safety, and if fixed 2ft. 6in. apart will take any class of car. It is claimed that this arrangement, while permitting cars to pass over, is proof against the passage of horses, cattle, sheep, pigs and ground game. In Fig. 12 we give an illustration of one of these by-passes.

FARM IMPLEMENTS.

Amongst farm implements there are few novel exhibits. We noticed, however, on the stand of W. N. Nicholson and Sons, Ltd., Newark-on-Trent, a new combined side delivery rake and swath turner, of which we give an illustration in Fig. 13. This illustration shows the implement set as a swath turner. The improvements embraced in the design include roller bearings for the gear box, front flyer and castor wheel, self-oiling devices on the brackets which are mounted on the flyer pegs to carry the rake bars, quickly removable gap pieces, adjustable tine sections for turning the off-side swath and separately mounted tines. There is a patented arrangement for lifting the rake bars, which keeps them parallel with the ground and with each other at all points of the lift, and since they are not suspended by swinging links in the usual way, the bars are firmly held while at work. Each end of the carrier frame is adjustable separately, so that the rake bars can be set exactly

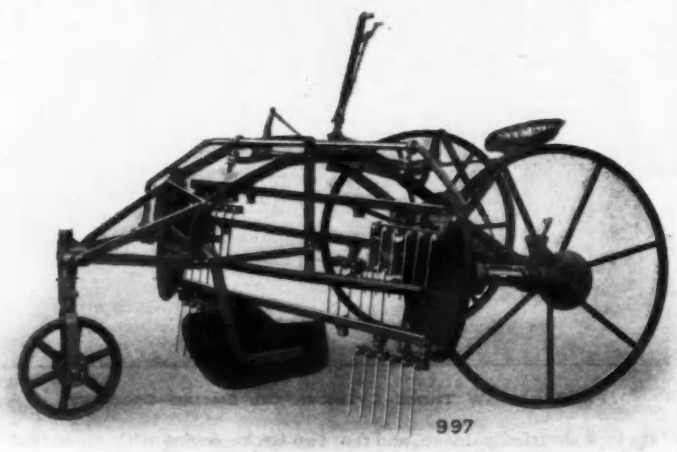


FIG. 13—SIDE DELIVERY RAKE AND SWATH TURNER—NICHOLSON

parallel with the ground when the machine is set to work. It should be mentioned that the weight of the rake bars is balanced by a spring which relieves the driver of exertion in raising and lowering the bars when turning. In this section Bamfords, Ltd., Uttoxeter, show two new implements—an artificial manure distributor and an expanding horse-rake. In the former machine the new feature comprises a fixed grid with two double reciprocating plates above and below the grid. These plates are supported on angle plates working on roller bearings and the manure is evenly distributed. Adjustments can be effected instantaneously without stopping the machine. In the new rake it is claimed that the contraction or expansion can be effected in one minute. By a simple operation a 28-toothed rake 10ft. wide can be contracted to 7ft. Bamfords, Ltd., exhibits also include a simple vertical oil engine, which was awarded a silver medal at the Harrogate Show last year. This engine is totally enclosed and has automatic lubrication, all the working parts being accessible by means of a hinged cylinder block. It has already been described in THE ENGINEER. Another new expanding horse-rake entered for the Society's silver medals is shown by Harrison McGregor and Co., Ltd., Leigh, Lancashire. In this implement the outstanding features are: (1) expanding ends, which are hinged on to the main frame and which can be folded up vertically when the rake is contracted; (2) a built-in lifting jack which is hinged on to the main frame; (3) taper teeth which are provided with guide brackets and which are so arranged that any one tooth can be removed without disturbing the others, and (4) a link arrangement for altering the depth and pitch of the teeth without affecting the shafts. Other machinery suitable for farmers shown on this stand includes grinding and crushing mills, mowing machines driven by spiral gearing and fitted with split knife heads with case-hardened steel bushes and connecting-rods with heat-treated detachable points; potato planters and diggers, crushing machinery and root cutters.

In thrashing machinery Richard Garrett and Sons, Ltd., Leiston, show machines for both home and colonial use which are provided with all recent improvements. The machines are of the orthodox trussed pattern, and the drums have reversible beater plates with rib-headed bolts. The top and bottom sections of the concave are, of course, also reversible. The shakers are longer than usual for this size of machine, while the cranks actuating them are of special design and give efficient separation, at the same time providing for the possibility of adding a straw trusser without any modification. The machines are now fitted with a divided blast, which embodies the result of long experience. The smutter barrel is of cast iron, extending the full width of the machine and is adjustable in several directions, first, as to the knives and the awner beaters, so that the treatment at any time necessary may be applied as required, and secondly, as to the delivery of the seeds which may be sent straight to the bags, through a portion of the smutter, or passed right through it according to the needs of any particular case. The rotary screen is

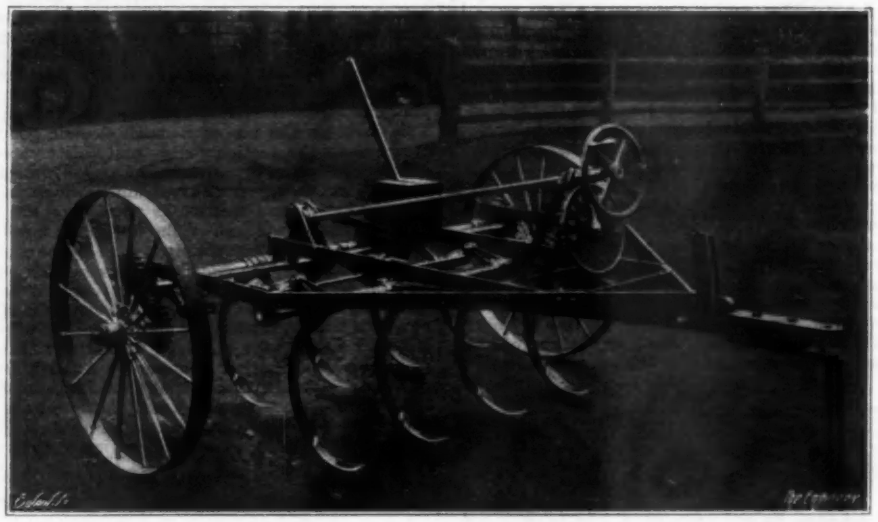


FIG. 14—NINE-TINE CULTIVATOR—WOOD

larger and is adjustable from either end. Scaffold doors and feed boards have been improved and a new and convenient fastening is now provided. The bottom shoe construction has been modified, in that the sides are composed of a number of narrow boards providing amply for climatic variations. The fore-carriage draw-bar eye-bolts are fitted with springs and the wheels have renewable bushes.

In the same category as the machines mentioned are two new cultivators shown by Walter A. Wood Company, Ltd., Horsham, Sussex. The machine illustrated—Fig. 14—has nine tines and is intended for tractor haulage. It has been awarded the Society's silver medal and is claimed to be the only machine of its kind with compensated tines, no springs or spring attachments being used, while ample flexibility is provided by the improved sytem of compensation, which enables the tines to be kept at a uniform digging depth. The lifting mechanism is also new and operates on both wheels by means of the gearing shown. The lubrication of the moving parts is on the Tecalemit system and there are large roller bearings on the main axles whereby friction is minimised and draught and power economised. The depth of digging is controlled by a worm and sector and can easily be adjusted from the driver's seat on the tractor. The depth is shown at a glance by the depth indicator. The horse-drawn cultivator has a similar arrangement of compensation of the tines and the weight of the driver is utilised to impart additional leverage to the operation of lifting the tines out of the ground at the headlands, thereby saving muscular effort.

Clayton and Shuttleworth, Ltd., Lincoln, whose name has been famous for thrashing machinery since 1852, when the firm was awarded the Society's silver medal for the first combined finishing thrashing machine, is making another solid attempt to solve

some of the farmer's present-day difficulties by the introduction of the harvester-thrasher, an illustration of which is given in Fig. 15. With this machine the ripe grain is not only cut in the field, but is thrashed and bagged at the same time with less labour and expense than that required normally to cut and stack the grain alone, thereby enabling the farmer to get his corn on the market earlier and making him free to prepare the soil sooner for the following crop. The machine may also be used for thrashing from the stack if desired. The general design is simple. Lightness combined with strength is one of the points which has been kept in view. The machine can be hauled either by animals or by tractors. When operating in the field the reaper section cuts the crop of grain, which falls upon a canvas conveyor, which, in turn, carries it to a feeder house. In the latter another conveyor feeds the cut grain to the main thrashing drum, in front of which a smaller drum ensures a uniform and constant feed from the reaper into the machine, allowing thrashing and grain separation to be effected under the most efficient conditions.

The thrashing drum is of a special design to meet the varied conditions encountered. It rubs the grain out of the ear against an adjustable reversible concave, by which the major part of the separation between the straw and grain is effected. A large proportion of the grain falls through the wired back of the concave

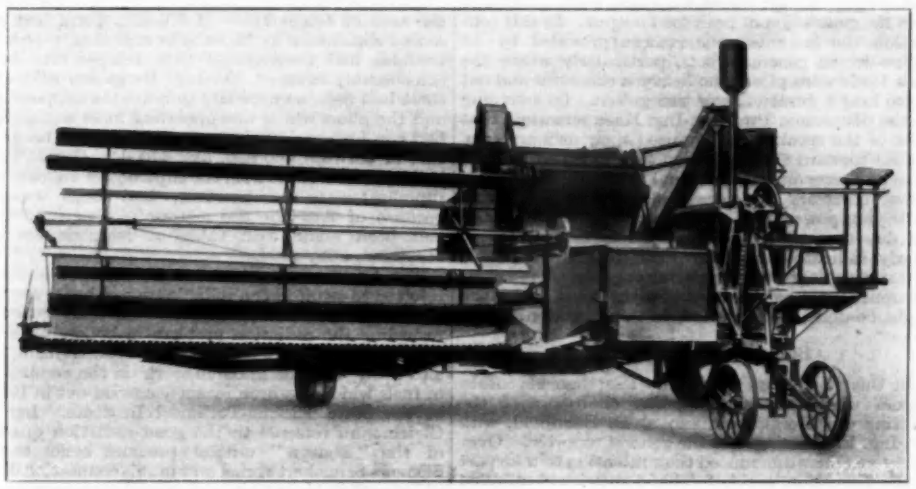


FIG. 15—HARVESTER-THRASHER—CLAYTON AND SHUTTLEWORTH

and is elevated directly to the first dressing apparatus without mixing with the straw. The remaining grain mixed with the thrashed straw is delivered to, and falls upon, four double crank shaker boxes. The length of these boxes is exceptional for this class of machinery, and to ensure thorough separation, particularly in damp and weedy crops, the straw in travelling over the boxes falls over two large drops, where it is violently pulled apart. Wires run the whole length of the lattice covering to prevent short straws falling through.

The grain, separated by the shaker boxes, falls through the lattice floor on to a reciprocating pan extending the total width of the machine, conveying it to the first dresser. The reciprocating motion for this dresser is received from two brass eccentrics operated from a chain-driven countershaft.

Riddles working in conjunction with an efficient blower in this dresser remove all short straw and chaff. Two speeds are provided for the blower fan for dealing with both heavy and light crops, and two adjustable diverting boards allow for a variation in the direction of the blast under the riddles, and the strength of the blast can be regulated from the bagging platform by opening or closing sliding doors fitted to the sides of the blower air intake. Any broken ears are separated at this stage of the dressing and fall into a trough in which an auger conveyor works, giving delivery of the ears at the side of the machine into an elevator which feeds to the top of the thrashing drum for re-thrashing. The separated grain in the first dresser is delivered by a grain auger into an elevator of large capacity which feeds into either a standard type of barley awner or into a distributing trough, whichever is fitted. If the barley awner is fitted, the grain is subjected to a polishing treatment, which is controlled by levers operated from the platform. From the barley awner, or distributing trough, the grain passes direct on to a recleaner, comprising two riddles, one superimposed on top of the other. A strong blast of air is directed between the riddles to remove any dust, &c. This recleaner has a reciprocating motion imparted to it by eccentrics on the spindle of the blower and the inclination of the riddles can be altered while working.

When efficient dressing takes place, a certain amount of grain passes over the end of the dresser. This overflow falls into a trough and is conveyed into the tailings elevator, mixing with the tailings from the first dresser and, contrary to the usual practice in other machines, this grain is not returned to the thrashing drum, where a considerable amount of breakage is frequently caused, but is separated and returned to the first dresser. The dressed grain from the recleaner is elevated into an adjustable rotary screen of large capacity, where a further separation of small seeds and small and broken grain takes place. The classified grain falls into various compartments at the bottom of the screen casing leading to bagging spouts.

To improve the conditions under which the bagging operator has to work, the bagging platform is fitted high up from the ground well away from the dust, and, to avoid the necessity of dismantling to reduce the overall width of the machine to enable it to travel along narrow roads, the platform has been designed so that it can be readily folded up. Motive power is provided by a four-cylinder petrol engine, 35 to 40 h.p., which is entirely enclosed so as to prevent dust having access to the working parts. The makers claim that with a travelling speed of 3½ miles an hour a 12ft. machine can cover over 40 acres per day.

Amongst the oldest exhibitors at the Royal Show is the firm of E. R. and F. Turner, Ltd., of Ipswich, whose outstanding exhibit this year is a drier for corn specially designed and constructed for the use of farmers, on the model of the drier which was used in the trials held by the Oxford University Institute for Research in Agricultural Engineering in 1928. The design of this machine has been carefully checked from the experience which Messrs. Turner have had in the manufacture of machines for the same purpose in the milling industry, and the machine which has been evolved and which is now shown is claimed to be the best for the purpose, taking into consideration that what the farmer requires is a less costly and less elaborate apparatus than that needed by the miller. The upper part of this machine is connected to a fan which draws hot air from a furnace, and the bottom part to a fan only supplying cold air for cooling and tempering the grain. The firm also shows a number of milling and grinding machines.

(To be continued.)

The World Power Conference at Berlin.

No. IV. *(conclusion).**

IN what follows we continue our account of the formal technical meetings, including the final meeting held on Wednesday afternoon, June 25th, at which the final report on the Second World Power Conference was presented by the assistant secretary, Dip.-Ing. F. zur Nedden.

STEAM TURBINES, GAS TURBINES, AND RECIPROCATING STEAM ENGINES.

An important section was that relating to the design and operation of steam turbines, gas turbines, and reciprocating steam engines. It included no less than thirteen papers, nine of which mentioned the use of high-pressure steam. There was a well-attended meeting, with a good, if somewhat inconclusive, discussion. The chair was taken by Prof.-Ing. Jan Kieswetter, and the report was presented by Prof. E. Jósse, of Charlottenburg. The papers were very representative in character and included reviews of progress in Great Britain, America, Germany, Austria, and Switzerland. In the paper by Prof. Dr. A. Stodola mention was made of economical designs of Swiss turbines running at pressures up to 200 atmospheres, or about 2840 lb. per square inch. For these turbines cast molybdenum steel casings were employed with non-erodible alloy steel blading. Tests made by Escher, Wyss had shown that with the same blading and the same steam velocities the efficiency was independent of the steam pressure. With short blades for low outputs, however, there was a substantial fall in efficiency. Mention was further made of two 3000 r.p.m., 50,000-kW condensing turbines working at 525 lb. pressure and 450 deg. Cent. initial steam temperature, which had only twelve stages in the high-pressure section and not more than twice that number of stages in the double low-pressure section.

Another interesting contribution from Switzerland was that of W. R. Felix and W. G. Noak, who analysed the effect on the economical stop valve pressure, of varying the output, steam temperature, drains and inter-stage heating, tappings, &c., having especially in view high-pressure designs. Turbines of the pressure type arranged in three and four cylinders for outputs between 15,000 and 50,000 kW were considered, and it was found that no improvement was to be obtained by increasing the steam pressure above 1950 lb. per square inch. The best heat utilisation was found to be 2785 kcal./kWh, corresponding to an overall efficiency of plant from the coal supplied to the current generated, of about 30·9 per cent. Prof. C. Colombi, of Switzerland, presented a paper on blading. In a paper by Sir Charles Parsons and Mr. Robert Dowson the question of the overload capacity of boilers, steam turbines, and generators, with their auxiliary machinery, was investigated, and it was concluded that it was advantageous to meet peak loads by overloading. A paper by Mr. G. A. Orrok was valuable as giving the operating results of power plants in the United States. The author found that there was a noticeable saving in coal with high-pressure plants, and the initial cost and the running and maintenance costs were scarcely higher than those for low-pressure plants. A high plant factor was an effective means of reducing the cost of current.

In outlining the possible future development of large steam turbines in the light of the General Electric Company's experience, Mr. G. B. Warren advocated the use of simple single-cylinder turbines up to 80,000 kW, operating at 450 lb. pressure and 400 deg. Cent. Space and lower costs resulted from adopting such designs. Increased output in the last stages per unit area gave lower turbine costs even although the exhaust losses were increased, while better performance was assured by using more efficient heat cycles and higher generator efficiencies. In a paper by Prof. A. G. Christie it was stated that in America the economic pressure for saturated steam was 480 lb. per square inch at 400 deg. Cent., but with clean coal and a high load factor as high a pressure as 1275 lb. with the same initial temperature had been found to be worth while, even with a 5 per cent. increase in cost for the high-pressure plant. The same author also dealt with inter-stage heating and said that in America the demand for larger output was more insistent than increase in efficiency. Peak load turbines were not generally used, but there was an increasing tendency to design turbines to work at 60 per cent. of the designed load with maximum economy, leaving a capacity for peak load demands.

In his review of recent German practice Dr.-Ing. A. E. Kraft, of the A.E.G., pointed out that turbines became uneconomical below a certain limit of the volume of the steam passing through on account of excessive gland losses and additional flow losses due to short blades. In comparing the condensing turbine with the reciprocating steam engine 500 kW was found to be the limit of favourable comparison; above this limit the turbine was assumed to be better both as regards price and fuel consumption. Back pressure and turbines with stage bleeding were finding increasing use, and in this connection it was of interest to note that the firm of A. Borsig, of Berlin Tegel, had recently constructed a three-cylinder back-pressure reciprocating steam engine for an output of 3760 kW working at 1500 lb. per square inch pressure and exhausting against a back pressure of 60 lb. per square inch. In a paper by Prof. Dr. F. Lösel a description of an 18,000-kW condensing turbine designed to utilise steam at a pressure of 1800 lb. per square inch and at 500 deg. Cent. temperature, built by the Erste Brünner Works, was given. The use of high-pressure steam in small units was illustrated by Ing. A. Demmer, who described a Löffler 1655 lb. per square inch boiler supplying steam at 480 deg. Cent. to a reciprocating steam engine of the single-cylinder double-acting type with a generator output of only 400 kW. The unit was economical in operation and required very little attention. An interesting reference was made by Prof. P. Langer to a new 2000-kW experimental combined gas turbine-steam turbine which is to be built by Holzwarth and the Brown-Boveri Company and will include the Büchi system of exhaust gas turbine charging. The paper also indicated the theory underlying this project.

Especial interest was attached to Dr.-Ing. E. Koenemann's paper on a new binary fluid system for turbine operation, in which ammonia vapour is used in the first stage and steam in the second. A characteristic of the Koenemann process is that absorption takes the place of condensation in the first stage and that fused salts are employed instead of aqueous solutions. The calculations showed that when using ammonia vapour at 120 lb. per square inch and steam at 330 lb. per square inch a saving in fuel of about 30 per cent. might be expected, compared with a condensing turbine of the same output working at 330 lb. initial steam pressure. The Koenemann system was

* No. III. appeared July 4th.

attracting considerable attention in Germany, and an experimental plant is to be constructed by a syndicate representative of engineering and chemical interests.

In his short review on the trend of development, Prof. Josse remarked that no final conclusions had been arrived at regarding the value of inter-stage heating, draining, and suitable blade materials, while opinions seemed to differ on the influence of short blades on efficiency. A point was raised by Mr. B. Pocobradsky, of Fraser and Chalmers Engineering Works, with regard to increasing the reliability of turbine working by the prevention of critical vibrations set up by the non-uniform flow of the steam between the stationary and moving blades. It was mentioned that successful research work had been done on this subject, and a patented construction had been evolved which gave a greater distance between the stationary and moving blades and a more uniform velocity, with total absence of vibration. The particulars and curves given in Prof. A. S. Christie's paper were brought into question by Mr. W. Baumann, of Metropolitan-Vickers, who expressed the opinion that the calculated variation of the rating of a given turbine frame with the load factor and the cost of steam were too great, as they did not take into account the reduction in capital charges for the boiler and condensing plants resulting from the higher turbine efficiencies. In a paper read before the Institution of Electrical Engineers in 1920 Mr. Baumann had already shown that this reduction, if taken into account, lowered the rating variation to one-half of what it would otherwise be. The curves given would not be accepted as a justification for the high leaving losses common in American practice. The opinion was expressed by Prof. Dr. E. A. Kraft, of the A.E.G. turbine factory, that for turbines of small outputs speeds up to 30,000 to 40,000 r.p.m, might be usefully employed. With regard to high-pressure turbines, experience had shown that the same efficiency could be obtained with a turbine working between 100 and 10 atmospheres as 10 and 1 atmosphere. With regard to turbine governing, throttle governing was not suited for back-pressure turbines on account of the drop in efficiency at the partial loads; also nozzle control was to be preferred even for condensing turbines. On the question of large turbines Dr. Kraft suggested that for moderate pressures a small number of stages should be employed. The low-pressure stages presented difficulty, but in large turbines large clearances might be given which would facilitate quick starting. For instance, an economically designed 85,000 single-cylinder turbine could be run up to speed in about twenty minutes. Where possible, single-cylinder construction was to be preferred, but multiple cylinders could be employed in special cases. The maximum output of a condensing turbine was fixed by the dimensions of the last stage. According to present practice, a wheel diameter of 2000 mm. with a blade length of 400 mm. with an outlet area of about 2·5 m. could be employed at 3000 r.p.m. Taking steam at about 500 lb. pressure and 425 deg. Cent. temperature that design gave an output of 27,000 kW with moderate outlet losses and enabled an overload of 30 per cent. over short periods.

Attention was called to a point in testing by Col.-Eng. G. Rabbeno, of the Royal Italian Navy, who said that when calculating the efficiency of a steam plant no one usually took into account the great drop in temperature which took place between the combustion chamber and the working fluid. It was necessary, in order to compare steam plant and internal combustion engines on an equal basis, to introduce a new term which he called entropy efficiency; this was

$$\eta_e = \frac{1 - T_0/T_1}{1 - T_0/T_c}$$

where T_0 was the absolute temperature of the heat rejected, T_1 that of the heat supplied, and T_c that of the combustion chamber. Several examples were given, and it was shown that, comparing the case for saturated steam at 500 deg. Cent. with superheated steam at 700 deg. Cent., there was a variation of entropy efficiency of 0·5 to 0·7 per cent. The practical use of such a term was that it enabled a true comparison of different systems of boilers and engines to be made.

Large-scale Power Storage.

The papers grouped under the section dealing with economic problems relating to power storage on a large scale were eight in number, and they gave a very complete and exhaustive accouunt of the present position of power storage in Europe and more particularly in Germany. The chairman of the meeting was Prof.-Dr. W. Wyssling and the general report of the section was presented by Prof. Dr.-Ing. R. Haas. The German authors gave a large amount of valuable information based on practical experience, regarding the various types of power storage plant now in operation, and analysed the application of the different systems for meeting base and peak loads. Considerable advance has been made in pump-fed hydraulic storage plants, and it was mentioned that by the end of 1930 the capacity of such plants in Germany will have risen to 600,000 kVA. Compared with the Charlottenburg steam storage plant of 67,000 kWh capacity, the Herdecke pump-fed storage plant has alone a capacity of 530,000 kWh. The relative advantages of natural and artificial water storage basins were discussed, and one speaker pointed out that the long life of the civil engineering side of the plant warranted much longer loans for construction, which would favourably affect the economics of such plants. A paper presented by a French author gave some interesting information on the evaporation of a lake situated at a high altitude in the Pyrenees. The results obtained showed that there was a daily evaporation of about 2 mm., which figure was more or less in accordance with the results obtained from other experiments which had given 2 mm. to 3 mm. as a probable figure. Although evaporation losses did not present any economic problem, the results were of considerable interest to hydraulic engineers. In the other papers accounts were given of the present situation of steam storage in Sweden and Germany and the possible utilisation of electric accumulators and oil engine-driven peak load plant for storage purposes. Comparative figures were put forward for the Ruths accumulator system and the constant-pressure feed water heat storage system successfully adopted by Dr. Marquerre at his 1500 lb. high-pressure power station at Mannheim. Many speakers took the view that the latter system had several advantages in lower first cost, the smaller size of plant, and the larger available storage capacity. Some particular instances of the application of power storage to economic problems in Italy, America, and Austria were also given. Although there were several speakers in the discussion, very few new points were brought out, but there seemed to be a general opinion that power storage could be made more profitable than the generation of peak load output. In this connection the instantaneous reserve provided by oil engine-driven generator sets, particularly where the peak loads were of not too heavy a character and not of too long a duration, was recognised. In summing up the discussion, Prof. Dr.-Ing. Haas remarked that most of the speakers had praised their own systems. He put forward the suggestion that it would be both wise and economical to spend part of the capital outlay necessary for storage plant on reducing and modifying power tariffs in such a way as to equalise the day and night loads and fill in the valleys so clearly indicated on many load diagrams. At his own station near Basel there was only some 5 per cent. difference between the day and night loads, and much might be done, he suggested, in this direction.

Boilers and Furnaces.

In this important section no less than seventeen papers were summarised. The chairman of the meeting was Berghauptmann a. D. Bennhold, with Dr.-Ing. F. Münzinger as the general reporter. Over thirty members announced their intention to take part in the discussion, and beforehand they were reminded of some words of an old German knight, which, freely translated, ran: "Look as if you meant it; speak up and get it over." The meeting was well managed, and even if the time allowed to each speaker was very short, a large number of different opinions was heard. A feature of the papers was the wide scope they embraced, giving particulars of boiler and furnace practice in Great Britain, of many countries on the Continent, the United States and South America. In a review of modern German practice Dr.-Ing. Marguerre and Professor Dr.-Ing. Rosin drew attention to the great progress which had been made in recent years with regard to the capacity of grates burning brown coal and pit coal and their efficiency and capability of control. It was noted that a single boiler having a drum 10 m. long could normally yield to-day 90 tons per hour of steam when fired with brown coal and 160 when fired with pit coal. The limit of output would seem to lie in the first case on the furnace side and in the second case on the steam side. With brown coal of low calorific value it was sometimes difficult to warrant the increased capital expenditure necessary for the lowest fuel consumptions. Ash, it was recognised, was the most difficult problem. In this connection Dip.-Ing. F. Zur Nedden announced that the Reichskohlenrat, or Government Federal Coal Council, had inaugurated a public prize competition, which was open to all engineers, for the best solutions of the problem of dealing economically with ashes and dust. A total sum of 5000 marks had been set aside and would form three prizes for the best solutions of the problem. An authoritative and representative jury had been chosen, and intending applicants might, he suggested, communicate with the Geschäftsfuhrer der Technisch-Wirtschaft Leichen Sachverständigenasschüsse des Reichskohlenrates, Berlin, W. 15, Ludwigkirchplätz 3 to 4, not later than January 1st, 1931. Dealing with brown coal or lignite, Ing. H. Zeuner gave some particulars of a re-designed boiler for burning powdered brown coal in which, by an alteration made in the size and arrangement of the combustion chamber, the output had been increased from 48 kilos. to 84 kilos. of steam per square metre of total heating surface per hour, and the efficiency from 76 or 80 to 84 per cent. The present-day American practice with regard to high-capacity steam boilers was referred to in a paper by Mr. E. R. Fish. Within a decade, he stated, the rate of combustion with stokers using forced draught had been increased from about 40 lb. to 70 lb. or 75 lb. of coal per square foot of grate area. A rate of 70 lb. meant a heat release of about 1,000,000 B.Th.U., which would evaporate approximately 800 lb. of water. Only coals with a considerable amount of volatile matter could be burned, however, at these high rates. In order to avoid objectionable smoke the furnace volume for stoker firing should be such as to give a maximum heat release of 50,000 to 60,000 B.Th.U. per cubic foot per hour. With powdered coal the maximum heat liberation should be 30,000 to 35,000 B.Th.U. Loss due to unconsumed fuel increased with the rate of burning, and varied with the type of firing equipment. With stokers it ought not to exceed 3 to 5 per cent., and 2 per cent. with powdered coal. Ash arresters still left much to be desired. With regard to preheated air, 350 deg. Fah. was the maximum for stokers, but there was no upper limit for pulverised fuel plants. An important British paper was that of Mr. A. Spyer, of Babcock and Wilcox, Ltd., who dealt with the design of special boilers to meet peak load conditions and some of the applications of steam storage. Although pulverised coal furnaces had attracted great attention in recent years, great improvements had been made, Mr. Spyer said, in the design of chain-grate stokers, and capacities of 310 kilos. per square metre of grate with an air temperature of 220 deg. Cent. had been attained. Both pulverised fuel and oil firing lent themselves well to sudden demands, but high-capacity stoker grates were also suitable for peak load demands and were not so complicated as were pulverised fuel furnaces. Some particulars of high-duty and high-pressure boilers on the Continent and in America were given, and the research work on such boilers now being carried out at Renfrew was referred to. In connection with a remark in Mr. Spyer's paper that the average temperature of 470 deg. Cent. had presented difficulties at Mannheim and that pipe-work troubles had necessitated that temperature being considerably lowered, Dr.-Ing. Marguerre said that there had been no necessity to lower the temperature, and the plant which was operating most successfully had run for over 8000 hours at an average temperature of between 460 deg. and 470 deg. Cent. There had been no trouble with the superheater tubes; four superheater tubes, however, had been renewed because of flaws in the material. Successful tests had been made with tubes of molybdenum and chromium alloy steel.

The Löeffler system of steam generation was also referred to as offering a reliable type of boiler for high pressures and temperatures. Several questions regarding the radiation problem in boilers were discussed in the papers presented by Prof. Ramzin, who also dealt with the research work on the combustion of fuels which has been recently carried out in Russia at the State Thermo-Technical Institute. Ing. H. Gleichmann referred to the good radiation qualities of the "Benson" critical pressure boiler at the Siemens Schuckertwerke, and in this connection it was of interest to learn that further radiation tests on this boiler are to be carried out by Prof. E. Josse, of Charlottenburg, before the end of the present year. Herr Gleichmann also spoke on the effect of prices on boiler design, which, he said, often made the fixing of the best efficiency a matter of great difficulty. Dip.-Ing. G. Cantieny found himself in agreement with Prof. Ramzin with regard to the increasing importance of direct radiation, and he made mention of a new type of radiation boiler. An important American paper was that of Mr. F. G. Straub, on "Intercrystalline Cracking in Steam Boilers," which included the recommendations of the A.S.M.E. as to the construction and care of steam boilers. Several speakers dealt with the question of cracks in materials, and in this connection forged and welded drums were, it was suggested, more free from this trouble than were riveted seams. The necessity of good workmanship was emphasised and the detrimental effect of vibration was touched upon. Reference was made to a special superheater steel which had been produced by the United Steel Companies of Germany and which, it was stated, would not easily blister and possessed a high tensile strength at very high temperatures. Tests on this steel had already been carried out in Germany, and creep tests were being completed in England. Several papers in the section dealt with the important question of boiler feed, and drew remarks from different speakers, who agreed as to the absolute necessity of pure feed water for reliable working. Ing. R. Kablitz described a new type of apparatus designed to recover the residual heat in the flue gases. It was, we gathered, of the "Cowper" stove type, and by its use air temperatures up to about 380 deg. Cent. could be attained. Automatic combustion control was discussed in an American paper by Mr. E. G. Bailey, who gave particulars of recent installations embodying automatic controls. The papers were excellently summarised by Dr. F. Münzinger, and this section held one of the most interesting meetings of the latter half of the Conference.

Combined Heat and Power Supply Plants.

There was a large gathering at this one of the two last technical meetings of the Conference, when the above-named subject was discussed. The general report was ably presented by Dr.-Ing. F. Marguerre, of Mannheim, who is well known on the Continent for his pioneer work in connection with the 100 atmospheres pressure power station at Mannheim. The chair was taken by Monsieur Parodi, and some twenty members participated in the discussion. The papers in this section were fifteen in number, and they included examples of heating and power supply practice in most European countries and in America. In a

joint paper by several of the officials of the German State Railways Company, the interconnection of a number of stations and repair shops, in order to effect a combined heating and power demand, was described and curves were given. It was mentioned that the equalisation of the load factor was frequently carried out by means of connections to public supply undertakings. Dr.-Ing. F. Marguerre, in collaboration with other German engineers, presented a *résumé* of the present conditions of combined heat and power plants in Germany. He estimated that if a pressure of 100 atmospheres were to be generally adopted then at least ten billion kilowatt-hours would become available from the steam produced in industrial plants.

The question of power production in steel works was raised by Monsieur E. Evain, who analysed the conditions for an iron and steel works with 50,000 cubic metres of blast-furnace gas per hour available. He compared the conditions for a gas station and a steam turbine station, and showed that, neglecting depreciation costs and assuming an average coal price, the steam turbine station with coal firing was cheaper. Dr. F. Heyd, in reviewing Czechoslovakian blast-furnace practice and the utilisation of waste heat, drew attention to the heat which might be recovered from the discharge and extinction of glowing bodies. He estimated that 200 kilos. to 300 kilos. of steam per ton of steel and 350 kilos. to 400 kilos. per ton of coke might be obtained by recovering the heat now lost during cooling. If the radiation heat of blast and steel furnaces and of the slag could be exploited then 1000 kilos. more steam would be obtained, which could be utilised in providing some of the 2000 kWh of energy which were approximately required to produce 1 ton of pig iron. The problem of running blast-furnaces with oxygen and its effect was dealt with by the same author.

Professor F. Niethammer, of Czechoslovakia, gave examples of stations which re-sold steam, and thus effected a comprehensive combined economy with regard to heating and power, beyond the confines of the station itself. An example of an exchange of power between a steel works plant and a public electricity supply station of the order of 15,000 kW, was given by an America contributor, Mr. G. E. Whitwell, while other American authors also dealt with the present position of power supply in steel works. Mr. W. F. Ryan was of the opinion that up to 5000 kW the reciprocating steam engine was thermodynamically superior to turbine plants. He also advocated the use of Diesel engines to balance the heat and power loads in individual plants, and discussed recovery of waste heat at lower temperatures.

An Austrian contributor, Ing. A. Demmer, compared the advantages to be obtained by using increased pressures between 20 and 130 atmospheres, with condensing and back pressure turbines. He pointed out that by such increases of steam pressure it was possible to obtain from 1 ton of steam an increased kilowatt-hour output. In this connection he figured that condensing turbines would require 1050 calories and back-pressure turbines 1350 calories. In the case of the condensing turbine, the condenser loss was reduced with increasing pressures by the increasing amount of heat removed at the turbine, but there was no such gain with the back-pressure turbine. Ing. B. M. Gerbel considered the economies of the turbine with intermediate stage bleeding, which was often recommended as the best solution for stations with fluctuating power and heat load demands. As to overall efficiency, the position was, he held, an entirely different one. He showed that it might prove quite economical to exhaust considerable quantities of steam to atmosphere, and thus avoid the cost of additional condensing plant. A formula for the limiting conditions was also given. The subject of town heating was discussed in papers by both French and American authors. Messrs. J. H. Walker and A. R. Mumford mentioned an average thermal efficiency of from 80 to 90 per cent. as being obtained in distribution plants. In most plants the high steam velocity of 820ft. per second and over was being employed. A full account of the heating and power system in use in Paris and its development was given by Ing. Schereschewsky, who gave 90 atmospheres as the pressure which is recommended to be employed in plant extensions. Other contributors referred to industrial plants in Finland and the general position of the heat recovery problem in Italy.

Speaking on the subject of town heating plants, Ing. E. Schulze gave expression to the opinion that an economical combination of electric power production and town heating was not possible in the older cities like Berlin, because the houses and other buildings were not equipped with properly designed central heating systems. Such schemes could be well utilised in newly planned townships where the necessary facilities could be provided. Dip. Ing. A. Margolis, who is connected with the Hamburg heating undertaking, gave particulars of a hot water tank for power storage which held 2000 cubic metres and was capable of storing about 100 million calories for heating purposes. The storage of heat energy thus effected helped to remove the electrical peak load during the morning hours, and by the use of the tank it was possible to dispense with old boilers of 2000 sq. m. heating surface.

In summarising the discussion, Dr. Marguerre remarked that there seemed to be a unanimous opinion that it was important to make use of the power which might be derived from high-pressure plants. The technical conditions for the use of this surplus power were solved in stations operating at 100 atmospheres pressure and above. Through such means large amounts of power were available, but the question was one of capital cost. The position with regard to equalising the demands for power and heat appeared to show some lines of development, and it was of the very greatest importance that those connected with electric power plants should work together with industrial undertakings to secure the desired end. A good deal of mutual understanding and goodwill would, however, be required to bring about ideal conditions.

The Lectures and Addresses.

A feature of the Second World Power Conference was the series of special lectures and addresses which were arranged by the International Council, and which have now been published as a first volume of the "Transactions" in the three official languages of the Conference. They include Professor Dr. A. Einstein's lecture on "The Physical Space and Ether Problem," an address by Professor Dr. D. Serruys on "The New Forms of Rationalisation," the talk by Mr. Foster Bain on "The Place of Minerals in a Power Sustained World," the description by Dr.-Ing. Oskar Oliven, of "A Proposed Superpower Scheme for Europe," and Professor Ing. G. Vallauri's address on "Electricity and Power"; also the charming lecture by Professor Sir A. S. Eddington on "Subatomic Energy," and Dr. A. F. Enström's stimulating address on "Machine Power as a Factor in Culture." There is no doubt that this innovation was a most successful one, and that it was widely welcomed by all the members attending the Conference.

The Closing Meeting of the Conference.

The concluding meeting of the Conference was held in the Kroll Opera House reception halls at three o'clock on the afternoon of Wednesday, June 25th, when the chair was taken by Mr. O. C. Merrill, who announced that there would be no discussion on the resolutions to be passed. He referred briefly to the results of the Conference which, he said, he felt sure had been the means of forming many new personal friendships and had cemented friendships among nations. Thanks were especially due to the Press for the admirable way in which the Conference had been reported in all countries. During the sessions valuable answers had, he thought, been given to important questions relating to economical power production. Mr. Merrill referred to a message received from President Hoover, in which the President looked forward to the next plenary Conference in New York in 1936, and extended a warm welcome to all members. After the official report, which follows, had been read by Dipl. Ing. F. zur Nedden, the Chairman called upon Mr. Ll. B. Atkinson, representing the British National Committee, to move the first resolution, expressing the deep appreciation of the Conference of the part played by German industry with the full encouragement of the German Government, and the great help given by the Verein Deutscher Ingenieure and its extensive resources. Mr. Atkinson, who spoke in English and then in German, recalled the first 1924 Conference in London, and expressed the general regret which was felt at the unavoidable absence of Mr. D. N. Dunlop from the Second Conference. The idea of Mr. Dunlop to call together in 1924 representatives of so many nations who at that time had so recently been involved in the frightful struggle of the world war, was a difficult experiment, but Mr. Dunlop's vision and courage had brought about a great success. The engineers of the world who were pioneers in so many other matters, were the pioneers in re-establishing through the intellectual world the spirit of international co-operation which had been lost through the material world. Mr. Atkinson, as one of the organisers of the First World Power Conference, paid tribute to the excellent organisation of the Second Conference, and the important part which German industry had played in that work. The resolution was seconded by Viscount Dr.-Ing. Inouyé, of Japan, who also spoke in German.

The second resolution, expressing the thanks of the Conference to the German National Committee and the Organising Committee, coupled with the names of Dr. Koettgen, Professor de Thierry, Professor Matchoss, Dip. Ing. zur Nedden, and Dr. Dehne, was proposed by Monsieur E. Brylinski, of France, and was seconded by Ing. R. Avramowitsch, of Jugoslavia. A third resolution, thanking the German Government, the City of Berlin, and all who had offered such abundant hospitality, was proposed by Ing. O. Jacobini, of Italy, and supported by Mr. J. W. Meares, representing India. This resolution referred to the Festival Performance of "Rosenkavalier," at the State Opera, and the World Power Banquet at the Sportpalast, at which over 4000 members and guests were present. On behalf of the German National Committee and the German Committee responsible for organising the Second Plenary Meeting, thanks to the National Committees and representatives of nearly fifty nations were expressed by Dr. Ing. C. Koettgen and Professor Dr. Ing. C. Matchoss. This resolution also referred to the authoritative bodies and individual authors who had presented nearly 400 technical papers.

The Chairman then declared the Conference adjourned *sine die*.

THE OFFICIAL CONFERENCE REPORT.

Conference Organisation.

The total number of registered members at the Second World Power Conference at Berlin was 3900. Two months prior to the commencement of the Conference the 380 papers were printed in the original language of the manuscript and were prepared for distribution among the members of the Conference. These papers were collected in 34 general reports, which were printed before the beginning of the meetings in all of the three official languages of the Conference, namely, English, German and French. The general reports can now be purchased in three separate volumes, printed in each of the above languages. Each general report contains a brief abstract of each of the papers dealt with by the report, a short summary of the trend of development as indicated by the papers, and points which were suggested for discussion. The preparatory work done was largely responsible for the unqualified success of the Conference.

The total number of members who participated in the technical meetings under the thirty-four sections of the Conference, based on the general reports, amounted to over 10,000. The greatest number at any technical meeting was somewhat over 1200. The average number of contributions to the discussions at the individual meetings was over twelve. The attempt made to transmit to the members the general reports and the contributions to the discussions by means of the speech-transmitting apparatus, in the other two languages of the Conference, at the same time the speeches were made in the original language, may be regarded as a successful one. It was possible to transmit satisfactorily all matter which had been sent to the Conference management in writing prior to the meetings, thanks to the careful training of the interpreters and the fact that they worked both day and night. The simultaneous speech-transmitting apparatus was also often astonishingly successful for the purely free discussion, and in all cases its operation was not inferior to translations rendered without a speech-transmitting installation. Only when the interpreter had to translate extempore, and the speaker himself was using manuscript, were such efforts not altogether successful, which, under the circumstances, was only natural. In any case, thanks to the time saved by the speech-transmitting apparatus, it was possible for 430 persons to take part in the discussions. The practical test to which the apparatus has been subjected has resulted in numerous valuable suggestions for its improvement. The seven general addresses proved to be a happy innovation. These products of the world's master minds greatly assisted in disseminating the spirit of the World Power Conference among circles hitherto but remotely connected therewith.

A number of important resolutions were passed during the technical sessions. The International Executive Council appointed a sub-committee to examine these resolutions, after they had been circulated to all the National Committees, and to make recommendations to the next meeting of the International Executive Council in 1931, when they will be again subjected to a thorough examination and appropriate action taken.

The International Executive Council.

The International Executive Council has set up, on the basis of some definite proposals put before it, a sub-committee which, after consultation with the National Committees, is to submit to its next meeting in 1931 certain proposals promoting the rational development and increasing usefulness of the World Power Conference. Among the principal matters regarding which recommendations are to be expected are proposals for avoiding in future too voluminous "Transactions" and for facilitating a continual exchange of power statistics and information regarding important publications between the National Committees. It approved of the decisions of the German Preparatory Committees for the Second World Power Conference to publish the Conference papers this time in twenty-one separate volumes, divided up amongst the various fields concerned and of selling these separately. Vol. 21, which contains the seven general addresses in their original languages, is already complete.

Very satisfactory progress was made with regard to consolidating the friendly relations with other international organisations. An understanding was come to with the International Commission on Large Dams and the International High-tension Conference with regard to the mutual demarcation of the fields of interest. The World Power Conference, in its future meetings, may count on receiving special reports of these organisations, which was already done in Berlin with regard to matter of the special report contributed by the International Commission on Large Dams, and similarly with regard to the proposal of the "Commission Mixte Internationale pour les lignes téléphoniques et les canalisations souterraines." The International Executive Council has agreed to an informal exchange of current information with these bodies. The International Executive Council resolved, as the result of three reports kindly furnished by the International Standards Commission, the Electrotechnical Commission and the new International

Association for Testing Materials, to continue to hand over to these organisations all standardisation problems falling within their scope, and to suggest that these organisations should decide among themseves as to the division of the work.

The International Executive Council of the World Power Conference having had brought to its attention certain proposals for the creation of a World Engineering Federation and also of a permanent World Engineering Congress, decided that such new organisation would result in overlapping with existing bodies and so would lead to duplication of activities and over-organisation of international work.

Of the four resolutions of the Fuel Conference in London, 1928, three are in the course of being carried into effect. The fourth, regarding the international regulation of the calorific value problem, was brought to a final solution at a special meeting on June 20th during the Second World Power Conference. It was unanimously agreed that the World Power Conference should utilise all the resources at its disposal to induce everybody when giving data based on calorific value always to make it perfectly clear, whether the upper or the lower, gross or net, calorific value forms the basis of such data. For this purpose an official list of the terms used for the two values is to be drawn up in all principal languages, as well as international indices for both. These definitions and indices are to be published during the current year. The international standardisation organisations mentioned above are to be requested to create an international standard definition for the upper and the lower calorific values.

The International Executive Council decided to accept the tentative invitation of Sweden and of the Scandinavian countries, and suggests 1933 as the date of the next Sectional Meeting of the World Power Conference to be held in Scandinavia on the question of "Power Supply of Big Industrial Undertakings." The third Plenary Meeting of the World Power Conference will take place in America in 1936. The International Executive Council recorded that it would welcome a discussion on the advantages and the disadvantages of charging for electricity on the basis of either the kilowatt-hour or the kilowatt-year or a possible combination of the two. It understands that the Union Internationale des Producteurs et Distributeurs d'Energie Electrique will give consideration to including this question in the agenda of one of its next meetings. Finally, the International Executive Council expresses sincere thanks to several organisations which were good enough to place at the disposal of its members and the National Committees a number of publications which were of the highest technical value.

General Results of the Conference.

It is, of course, impossible to enumerate in a few words, the numerous and important individual results of the Second World Power Conference. These may be obtained from the "Transactions" of the Conference. The intention is to forward to the National Committees, with the help of the general reporters, comprehensive surveys of these results within the next few weeks and to publish them in the Press.

Mention may, however, be made of a few of the more important general results. The most important result is, undoubtedly, the fact that so many experienced specialists from all over the world come into personal contact with each other. Quite apart from the value which this fact has for the individuals and organisations concerned, it has greatly served to bring the different nations into closer touch. The Second World Power Conference owes a great part of its success to the sympathetic collaboration of the daily and technical Press, which, throughout the whole duration of the Conference, emphasised the value and objects of the Conference work, both to lay and technical circles all over the world.

The Second World Power Conference, as a whole, has, it is considered, given answers to important problems which it has been called upon to help to solve by leading statesmen and by the whole world. It visualises two methods by which power may be cheapened. First, the reduction of the cost of power generating and distribution plant by the numerous methods of a technical and executive character described at the Berlin meetings, and, secondly, greater economy by increasing the number of full load annual working hours of the plants. All the papers and discussions, practically without exception, directly or indirectly dealt with these two aims, which, in fact, formed the general theme of the Conference. The Conference, moreover, tended to show that the supplying of the world with mechanical power, light and heat, must, in the long run, lead to a reduction of unemployment. The tendency of power supply is to multiply from year to year the methods by which raw materials are transformed into finished products. Every new method is accompanied by new possibilities of work, and each fresh method requires in its turn new products for carrying it out and thus increases the markets for the products of labour. This increase in the possibilities of work is proved by the experience during the last 150 years to be greater than the reduction of the demand for physical labour due to the machine, for otherwise the population of the civilised countries could not have increased at such a rate during the interval. Finally, the Conference has opened up greater perspectives for the future, both with regard to the scientific and technical, as well as the economic and sociological fields. This was a particularly noteworthy feature of the general addresses, which revealed an intimate connection between what previously would apparently have seemed, in all their ramifications, essentially separate fields of present-day theory and practice, showing that we have already entered an epoch in which, after passing through a period of extreme specialisation, we shall finally reach a harmony of spiritual culture.

Some Social Events and Visits.

The space at our disposal only allows us to deal very briefly with the excellent programme of social events and visits which were arranged for members attending the Conference. We have already referred to the World Power Banquet in our second article, and in this connection there should be mentioned the very successful dinner given in honour of the German National Committee, which was held at the Hotel Kaiserhof, under the chairmanship of Monsieur M. E. Tissot, Vice-chairman of the International Executive Committee. A large number of members attended.

Very successful informal gatherings of the experts in different engineering groups were also held at the invitation of trade associations, and were greatly appreciated. Among the more noteworthy social excursions we single out those to Potsdam and to the Havel Lakes and Wannsee, which were very much enjoyed. During the whole period of the Conference, both the civic authorities and engineering firms in Berlin and district threw open their power stations and works, and many members took the opportunity of seeing for themselves some of the installations referred to in the papers. The ready assistance given by Graf Schwerin in arranging these excursions should be mentioned, also the help given by Dip. Ing. Landsberg on all matters relating to the Press. The German State Railway Company arranged an interesting demonstration of its new locomotives, and during the second week of the Conference an opportunity was given to members to participate in demonstration runs from Berlin to Magdeburg.

When the Conference adjourned on Wednesday, June 25th, the official excursions began. They were seven in number and included visits in the neighbourhood of Berlin, to the industrial regions of the Rhine and Westphalia, through Central Germany to the south-west and Baden, to Bavaria and the south *viâ* the Central German lignite mining district, to Upper Silesia *viâ* Saxony and Lower Silesia, to Pomerania and East Prussia, and to the north, visiting the Hanseatic towns. On all these visits complete arrangements were made for seeing interesting industrial and engineering works, and thanks are due to the various firms and public undertakings which allowed members to inspect their plants and to see some of the more outstanding works of German engineering which have been completed in recent years.

Canadian Trade.

At a meeting of the Overseas Trade Development Council on June 24th, Sir William H. Clark, High Commissioner in Canada for His Majesty's Government in the United Kingdom, discussed the development of United Kingdom trade with Canada, especially in relation to the enlarged tariff preferences accorded to this country in the recent Canadian Budget.

In the first place, Sir William Clark emphasised the importance of the Canadian market not merely in relation to the present, but having regard also to the future development of the Dominion. He had come back after a year and a half in Canada profoundly impressed with the fundamental strength of her economic situation and the promise of her future. He invited the Council to consider her remarkable progress in the last 15 years. In 1913, for instance, her exports amounted only to £73 million, equivalent to about £110 million in current values, whereas by 1929 they had risen to £273 million. Her imports in 1929 amounted to some £253 million. If imports had not shown a conspicuous increase like exports, it was owing to the remarkable increase of production in Canada herself. There had been, especially in recent years, great development of her mineral resources; but the special feature of her economic progress was the notable growth of her industries. This might at first sight be thought a factor not too promising for export trade to the United Kingdom, but it was necessary to take into account the greatly increased purchasing capacity which had accompanied it and which had correspondingly enlarged Canada's demand for many industrial products which she did not manufacture herself. As a result of all this progress she now stood fifth of all countries of the world in aggregate external trade, coming next after the United States, United Kingdom, Germany and France, and was easily first of the five in external trade, as measured per head of population. Her achievement, indeed, was the more remarkable in view of her as yet comparatively small population of some 10 millions. It was a tribute to the high degree of organisation and mechanisation alike in agriculture and industry. In this connection Sir William called attention to her immense resources for the production of hydro-electric power which were being so efficiently developed and which were affording power for her industries on probably the cheapest terms of any country in the world.

Taking all these factors into consideration he doubted if there was any country to-day which was more likely to show rapid economic progress in the immediate future. He wished, therefore, to emphasise once again the importance of British business strengthening its position in a market already so valuable and with such promise of further advance.

At the present moment, Canada took some two-thirds of her total imports from the United States and only one-sixth or one-seventh from Great Britain. Sir William felt that the moment had come when there was a real chance that this disparity might be lessened if appropriate efforts were made by United Kingdom exporters. Increase in duties under the United States tariff was making trade more difficult for Canada with the United States, and she was looking naturally to Great Britain, which, from early days, had been the outstanding market for her staple products. Apart from this, so to speak, business motive, there could be no doubt about Canada's willingness to buy more from the Mother Country. It had been his privilege to travel widely throughout the Dominion and he found everywhere a growing desire to buy from the United Kingdom goods not yet produced in Canada herself. The increased preferences in the Budget were one expression of this desire. United Kingdom exporters, on their side, could best manifest their appreciation of the opportunities thus offered to them by using them to the full.

As regards the increased preferences themselves, Sir William pointed out that they covered a very wide range of headings in the tariff which he was not competent to discuss in detail, but which, no doubt, were being studied by the various industries concerned. The whole tariff scheme, he understood, had been drawn up after most detailed examination by the Canadian Tariff Board of the many questions involved. The double object in view had been to stimulate Canadian industry and to give every possible advantage to Great Britain. He had had the privilege of some talks on the matter with Mr. Dunning, the Finance Minister, who greatly hoped that the many tariff concessions would result in increased imports from the United Kingdom and urged that every effort should be made to utilise them. There would appear to be special openings under the iron and steel schedules, for tableware of china and porcelain, and for machinery of many kinds. He thought that this latter heading would be particularly worthy of study by United Kingdom manufacturers in view of the wide range of mechanical development which was going on in Canada and the large amount of constructional work, including roadmaking, improvement of waterways, &c., which was being undertaken.

Sir William Clark then went on to discuss methods of attack on the Canadian market. He pointed out that the market presented certain special difficulties. There was on the one hand the intensive competition from the United States, which enjoyed great geographical advantages. There was also the remarkable growth in manufacture within Canada herself, to which our trade should be so far as possible supplementary rather than competitive. In addition there was a factor which, perhaps, those who lived in a somewhat conservative country like the United Kingdom were apt to overlook, namely, the constantly changing demand arising from changes in conditions of living and the increasing use of mechanical devices in domestic life. All these considerations necessitated a very close study of the market, and he occasionally heard complaints when travelling about in Canada that United Kingdom manufacturers did not take enough trouble to ascertain in person precisely the commodities which were required, or, in the major industries, did not maintain such effective organisations as some of their rivals—organisations which would enable them to make prompt deliveries from stocks held in the Dominion or to give service where required. He realised to the full the difficulties involved, and was very far from wishing to give the impression that United Kingdom exporters as a whole failed to take the necessary steps to develop their trade. It was always, unfortunately, easier to hear of cases where there was ground for complaint than of those where the machinery of trade worked smoothly, and, if necessary, he could give the Council many instances where United Kingdom firms had admirable organisations for the handling of their trade and were benefiting accordingly. At the same time, he felt that a market which was already so important in itself and which was widening so rapidly was one which constantly merited fresh investigation. There were alternatives which required careful consideration by the different industries concerned—whether in the special circumstances of each industry marketing could be most efficiently conducted by agents, by marketing organisations of the home firm established in Canada, or, in some cases, by the initiation of branch factories, at any rate, for partial manufacture in Canada. Another question which he hoped would be explored would be that of the possibility of alliances with Canadian producers. Some healthy competition there must always be, just as in each of the countries of the Empire there was competition between manufacturers at home; but it must be to the benefit of inter-Imperial trade for our respective manufacturers to avoid, so far as possible, direct competition with one another.

In conclusion, Sir William Clark urged again that a very special effort should be made to increase United Kingdom trade with Canada. It would be a mistake to assume that the better results which were desired could be secured without effort. But the new tariff was an invitation to make a new effort, and he felt very sure that such an effort would be warmly welcomed in the Dominion. He urged that the first steps should be for the different manufacturing industries of the country to study closely the new advantages offered them under the Canadian Tariff, and then that they should spare no trouble and expense to explore how best they could handle their trade and push the sale of their goods in the Dominion.

A representative of Mr. John D. Rockefeller, jun., and the Radio Corporation announced recently that plans were being considered for the construction of a theatrical and wireless broadcasting centre at a cost of 250,000,000 dollars (£50,000,000) in the middle of Manhattan. The site, bounded by Fifth and Sixth Avenues and Forty-eighth to Fifty-first Streets, was originally acquired by Mr. Rockefeller for a new metropolitan opera house. Four theatres, twenty-seven broadcasting studios and numerous office buildings, one of which is to be sixty storeys high, are included in the construction plans.

Railway and Road Matters.

As from July 1st all second-class travel on the Great Southern Railways of Ireland was abolished, and the ordinary first-class and third-class fares were largely reduced.

At the meeting of the London County Council on July 8th the Highways Committee submitted a recommendation that the Council should not seek powers in the coming session for the construction of new tramways.

Colour light signals for controlling the vehicular traffic through Ludgate Circus will be brought into use on Sunday next. They are operated by a police officer, and differ, therefore, from those usually found in other cities which are automatically operated by a time switch.

It was announced at the annual meeting of Spiers and Pond, Ltd., on July 2nd, that the termination of the catering contract with the Southern Railway, mentioned in this column on June 27th, does not apply to the South-Western Hotel at Southampton, as that is held under a separate lease.

The published traffic receipts of the railway companies for the twenty-sixth week of the year show that the total receipts for the first half of the year had the following decreases:—London, Midland and Scottish, £1,628,000; London and North-Eastern, £829,000; Great Western, £532,000; Southern, £136,000.

Railway engineers will be pleased to notice that the two representatives from the Institution of Civil Engineers on the London County Council Advisory Committee on the Charing Cross Bridge scheme are Mr. W. W. Grierson and Mr. E. F. C. Trench, formerly engineers-in-chief of the Great Western and London, Midland and Scottish railways respectively, and both past-presidents of the Institution.

There can be only a few people who know that Mr. T. M. Healy, the late Governor-General of the Irish Free State, was an old railwayman. His photograph has just been sent to the Railway Museum, York, and a covering letter states, says the *London and North-Eastern Railway Magazine*, that he was shorthand secretary to the station superintendent, Newcastle-on-Tyne, from 1872 to 1878.

A correspondent of the *Manchester Guardian* said recently that 200 men in the Middlesbrough district of the London and North-Eastern Railway had been told that they were redundant as a result of re-organisation. The ranks affected include inspectors, drivers, firemen, guards and shunters, but it is hoped to find work for them in other grades. The scheme of re-organisation in question is estimated to save £30,000 a year.

The annual Railway Returns for 1929 have now been published. They contain particulars of the capital, receipts, expenditure, and working results of British railways. Hitherto these have been published at about 20s. each. This year the price is 6s. 6d., and the returns can be obtained from the Stationery Office. Another reduction in price is that of the Railway Accidents Return for 1929. It is now 6d., as against the former price of 1s.

The Returns of Accidents and Casualties—usually known as the Railway Accidents Return—for 1929 was issued on July 1st. As it can be obtained from the Stationery Office for 6d., there is no occasion for us to review the figures therein contained. Suffice to say that hardly under any heading has there been an increase over the previous year or even over the average for some years. It may be added that the return will be reviewed at length in the annual report of the Chief Inspecting Officer.

At Sasso, on the main line between Bologna and Florence, of the Italian State Railways there was a serious head-on collision on July 3rd between an express passenger train and a standing freight train, both drawn by electric locomotives. Sixteen persons, including some railwaymen, were killed. As we read the reports in the Press, the line is single-tracked, and the two trains should have passed each other at Sasso. The single line loop points that were facing to the arriving passenger train were apparently undergoing repairs, and evidently were "set" for the wrong road.

The report of Colonel Anderson to the Ministry of Transport on the collision of December 11th last between a tramcar and an omnibus in Ponders End, when four people were killed, has now been issued. The driver of the omnibus swerved to avoid a cyclist, and met, head on, the tramcar, which he could not see because of a car in front of him going in his direction. Colonel Anderson thought that he would have cleared the cyclist and the oncoming car if he had made an emergency brake application. In doing what he did, the man committed "an error of judgment of a kind which is surprising in a driver of his experience."

The *Railway Newsletter*—the official publication of the British Railway Press Bureau—gives in its issue of July particulars of the road transport organisations with which the railway companies have now become associated, mainly by holdings of an equal number of shares as the original proprietors. The areas served are also named. Some of the benefits claimed are:—Interavailability of return tickets by omnibus or rail; service arrangements to facilitate exchange between railway and road services; combination of railway and omnibus time-tables and an adjustment of services where possible to improve connections; employment of omnibus transport as extension of railway journeys for pleasure and other purposes.

The Bill of the London and North-Eastern Railway Company has been before a Select Committee of the House of Lords, and was there approved on July 3rd. One portion was for the sale to the Hull Corporation of the disused Queen's Dock in that city, and the other portion related to the dock charges. Similar proposals as to the latter were before Parliament from the L.M.S. and Southern railways, and it has been agreed that the decisions as to the L. and N.E.R. Bill should govern the other two. The charges are, as a rule, 60 per cent. higher than in 1913, and are subject to an Order of the Ministry of Transport, which had to be renewed from time to time. The present Order expires on October 1st next, and it was desired that it should be extended indefinitely, subject to any interested party appealing to the Ministry of Transport for revision.

Notes and Memoranda.

Tar of 99·5 per cent. purity was extracted from the bituminous sands of the McMurray area in Northern Alberta recently as the result of the development of a process for utilisation of the tar sands by Dr. K. A. Clark, of the University of Alberta.

It is estimated that an area of 50,000 acres in the Kikuyu Escarpment Forest Reserve of East Africa can be used for the growing of bamboo for making paper pulp. The annual production is estimated at 40,000 tons of dry unbleached pulp suitable for making white paper of good quality.

Some trials carried out by the Imperial Institute on the use of charcoal from British Guiana as a fuel for motor lorries, using a "gazogene" gas producer, show that with the charcoal at £3 a ton and petrol at 1s. 6d. a gallon, the cost is 2s. 6d. per 100 miles with charcoal and 11s. 4d. with petrol.

The application of anhydrous ammonia to the filtered water prior to chlorination, has been effective in eliminating chlorinous and chlorphenol taste and in improving the bacterial quality of the Cleveland (Ohio) water. Experimental work on taste prevention processes led to the adoption of this method in preference to that of activated carbon.

In concluding a paper contributed to the British Waterworks Association, on the afforestation of watersheds, Mr. R. L. Robinson said that an important point was the possibility of the Afforestation Commission and a municipality co-operating before the acquisition of a catchment area. One is inclined, he went on to say, to think that joint procedure in regard to water collection and afforestation might, in some cases, tend to allay public opposition to the utilisation of land for water purposes only.

The combustion chamber of a boiler on a steam drifter collapsed on account of shortage of water, which was explained at the official inquiry by the fact that the water gauge was out of order and did not give a true reading. On the steam connection of the gauge there was a screw-down valve, which was used as a throttle to check the surging of the water in the gauge as the vessel rolled. The spindle of this valve was found to be slack, and it is assumed that vibration caused it to close entirely and thus put the gauge out of action. It has been recommended that the valve should be replaced by a cock.

The day of the old-fashioned prospector, toiling on foot with a heavy pack in search of buried treasure, is rapidly passing in Canada. His place is, says *Canada*, being taken by the skilled engineer, who enlists the help of the aeroplane and the wireless in his everyday operations. For his convenience a daily air service is now provided from Hudson and Sioux Lookout on the main trans-Continental line of the Canadian National Railways to the famous Red Lake Gold Field, calls being made at Gold Pine, Woman Lake, Narrow Lake, Pickle Lake and other mineralised districts of this area. His equipment almost invariably includes a reliable portable wireless set with which he picks up instructions periodically from headquarters.

It is, according to a recent Board of Trade report, the usual practice with steam trawlers for steam to be raised in the boilers by a shore staff, the enginemen not coming on board until the vessel is ready for sea. It is stated that twelve hours is the usual time occupied for raising steam from cold water to 180 lb. per square inch, no circulating valves or other device being fitted to equalise the temperatures in the boiler during the process. Neither is it the practice to blow out a part of the colder water from below the furnaces and allow hot water to fill this part of the boiler. The natural convection currents, which are unlikely to disturb the water in this vicinity, are relied on entirely to produce circulation. The natural result of such a process was the collapse of a furnace crown, but fortunately no one was hurt.

Cobalt-tungsten-carbide alloys have been most successfully employed in machining metals at high speeds, and in increasing the life of cutting tools. An alloy of this type, manufactured in the United States, may be said, according to the *Bulletin* of the Imperial Institute, to consist of particles of tungsten-carbide which have been cemented by metallic cobalt in an electric furnace of the resistance type. The durability of the material is much greater than that of high-speed tools, and it has been used in cutting threads upon glass, in cutting concrete, porcelain and nickel steel. For drilling in concrete or rock it is less expensive than the diamond drill, and is stated to cut a smoother hole than does the "star" hammer drill. A similar alloy is manufactured in Germany. The hardness of these cobalt-tungsten-carbide alloys in the Brinell scale varies between 1250 and 1400, as compared with 1000 for the hardest steel.

Petroleum coke is, according to a recent report of the American Bureau of Mines, essentially a by-product of refining operations, and cannot profitably be produced except as the result of the manufacture of other products. As a by-product, however, it has an annual value in excess of 7,000,000 dollars. Viewed as a raw material for further manufacture, it is regarded as the purest form of industrial carbon available in large quantities, and as such is essential to many important industries. Production of petroleum coke in coking-still operations has remained fairly constant during recent years at approximately 350,000 tons annually, while the production of cracking-still coke has increased from approximately 200,000 tons in 1921 to nearly 1,100,000 tons in 1928. Coking-still coke has a definite market as a raw material in the manufacture of electrodes and other carbon products, and is shipped to foreign countries for similar use. On the other hand, cracking-still coke extracted from the reaction chambers of cracking stills is in fine sizes and is sold for industrial pulverised fuel use, at relatively low prices. If cracking still coke is to become of increased importance in the industrial arts or is to bring a larger return to its producers, it should receive further treatment to reduce its volatile content, increase its strength, and provide uniformity in quality. Cracking-still coke subjected to such additional treatment should find an enlarged market as a "smokeless" fuel for domestic heating and an increased application in certain industrial processes.

Miscellanea.

It is proposed to make a survey of Mongolia and Tibet by means of aeroplanes.

An exhibition of British Polar exploration relics has been opened at the Central Hall, Westminster.

An artificial fertiliser plant is being constructed at Hamilton, Ontario, at a cost of 1,000,000 dollars.

The number of students on the roll of the Calcutta Technical School, now in its fourth year, is about 140.

The Hanover Technical High School will celebrate its hundredth anniversary from June 14th to 16th in 1931.

The organisation of a Fuel Research Institute has been officially sanctioned by the Government of South Africa.

The Central Customs Administration of China is endeavouring to impose a 12-mile limit on territorial waters.

The Chinese Government is proposing to expend some £300,000 on surveys for two new ports, to be known as the Great Eastern and the Great Northern.

The prospectus of the British Industries Fair, Birmingham, which is to be held from February 16th to 27th, 1931, has just been issued by the Birmingham Chamber of Commerce.

The China Merchants Steam Navigation Company contemplates the construction of twenty-four new vessels for river, coastal and overseas service. Their cost is estimated at about £1,000,000.

The plant of the Algoma Steel Corporation at Sault Ste. Marie, Ontario, is to be extended so that rails of up to 130 lb. per yard and heavy structural sections may be rolled. The extensions are to cost 1½ million dollars.

A Central Industrial Laboratory for testing and passing various industrial machines and instruments manufactured in China, as well as for the designing of new machines to meet special industrial needs, will shortly be opened by the Ministry of Industry, Commerce and Labour. The premises of the Nanking Mint have been obtained for use as machine shops, which will be put in operation as soon as the equipment arrives from abroad.

The works in connection with the improvement scheme in the Madras Harbour are, says *Indian Engineering*, progressing fairly well. In the new north quay pile sinking is still in progress, and it was hoped that this part of the work would be completed in June. The decking work for the surface of the quay will be started shortly. A beginning has been made with the columns for the new ground-nut shed, and about twenty have now been erected. Improvements are being made in the workshops and septic latrines, and a new tiffin shed is in course of erection. The steam pumps operating the hydraulic cranes are being replaced by electrically operated pumps.

A return has been issued by the Ministry of Transport giving particulars of the number of motor vehicles registered for the first time under the Roads Act, 1920, during the month of April, 1930. Copies, price 2s. 6d., can be obtained from his Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. The number of new motor vehicles registered was 34,324, compared with 34,602 in April, 1929. The return shows the number of each class of vehicle registered for the first time by each licensing and registration authority, analysed in detail according to various taxation scales, *e.g.*, motor cars under headings of horse-power, goods vehicles under headings of unladen weight, hackney vehicles under headings of seating capacity, &c.

The Department of Overseas Trade has announced that the British Industries Fair, 1931, will open in London and Birmingham as usual on the third Monday in February—the 16th—and will close on Friday, February 27th. By the addition of two floors of the Empire Hall, Olympia, which were not available last February, the exhibiting area of the buildings will be increased by 50,000 square feet to a total of 300,000 square feet. Following a recommendation by the Exhibitors' Advisory Committee, it is announced that the Fair in London will open and close half an hour earlier than in previous years. That is to say, the hours will be 9.30 a.m. to 7.30 p.m., and the public, instead of being admitted from 4 p.m. to 8 p.m., will be admitted only from 4.30 p.m. to 7.30 p.m. and from 1 p.m. to 7.30 p.m. on Saturday, February 21st.

From now onwards direct representatives of the Birmingham Chamber of Commerce, which is responsible for the organisation of the Heavy Section of the British Industries Fair, will be centrally located in various parts of the country. For this purpose, manufacturing interests in engineering, building and road construction, agriculture, electricity, gas, heating and lighting in general, hardware, transport and the other "heavy" industries, have now been divided into the following areas:—London, No. 1, extending to Bournemouth in the South-West; London, No. 2, extending from Norfolk to the Kent and Sussex Coast; Yorkshire, Lancashire and North Wales; North-East Coast; Scotland. In these respective areas, representatives of the Birmingham Section of the British Industries Fair will in future be at the immediate call of manufacturers who desire guidance on matters tending to the most effective demonstration of their products.

As a memorial to the late Sir George Beilby, a fund was collected in 1926 from the interest on which awards are to be made from time to time to British investigators in science, to mark appreciation of distinguished original work, preference being given to investigations relating to the special interests of Sir George Beilby, including problems connected with fuel economy, chemical engineering and metallurgy. The administrators of the fund—the Presidents, Treasurers and Secretaries of the Institute of Chemistry, the Society of Chemical Industry and the Institute of Metals—have announced the award of £250 each to Dr. Guy Dunstan Bengough, of the Chemical Research Laboratory, Teddington, and Mr. Ulick Richardson Evans, of Cambridge. Dr. Bengough has gained an international reputation as an authority on corrosion, and Mr. Evans, during the last few years, has been occupied mainly with research work on the corrosion and passivity of metals, and on the properties of the thin oxide films frequently present on the surface of metals.

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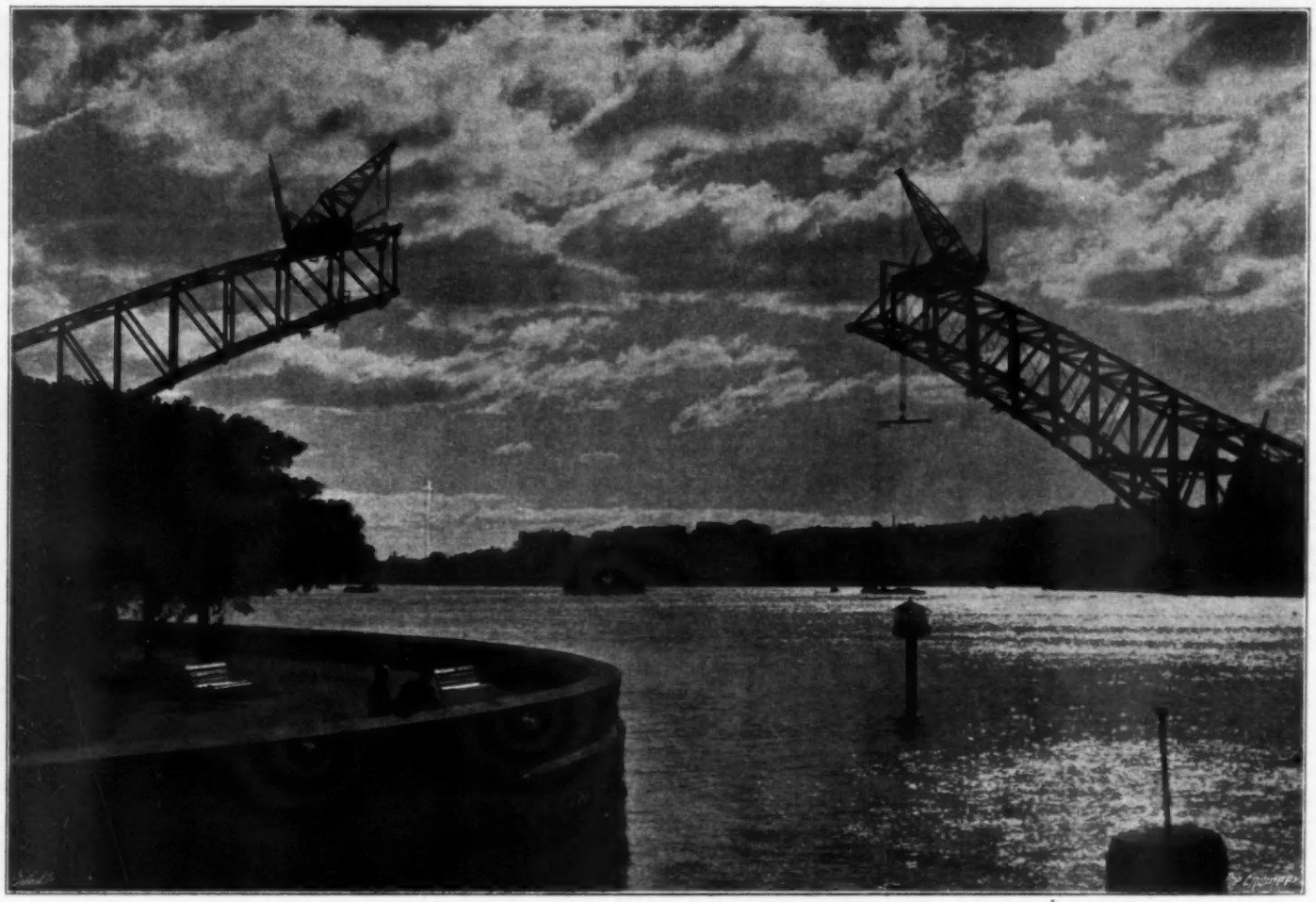

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NOTICES TO READERS.

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THE ENGINEER.

VOL. CL No. 3887

JULY 11, 1930.

Flowers in the Boiler Shop.

THOSE members of the Institution of Mechanical Engineers who, last week, visited the Swindon Works, saw an astonishing thing. High on the pillars that support the roof of the boiler shop brackets had been riveted, and on those brackets stood vases of culled, and pots of living flowers! Saw anyone, ever, the like of that before! Parterres around the buildings to give cheerfulness, shrubs in odd places to prevent the dumping of unconsidered trifles, bouquets and vases in the offices—these things we have seen, but flowers "all a-blowing and a-growing" right inside a boiler-shop, cheek by jowl, so to speak, with pneumatic tools and rivet furnaces, surely this is something unheard of till now. Were they put there to surprise the visitors? Were they hung out like flags to show that the works were *en fête?* Were they mere *ephemeridae*, destined to be the cockshies of the rivet boys as soon as the august backs of the Institution of Mechanical Engineers were turned? Were they this and nothing more? Emphatically no; they were, and are, the living symbol of the new spirit which has fallen upon factories, even upon boiler-shops, and has banished the dirt and gloom, the reckless shin-breaking scattering of material, the grimy floors and reeking roofs in which many of us learnt the art and mystery of mechanical engineering.

Those who visited many works during the Bristol week had grown accustomed to the prevailing tidiness. It did not, perchance, surprise them to see it scrupulously observed in cocoa works and tobacco factories; but they commented upon it when they saw every part of an aero-engine works as neat as a new pin, and the climax was fittingly reached on the last day when they wandered through this boiler-shop at Swindon. It was natural to ask what it meant; what was the value of this departure from long-dated tradition? The answer in the boiler-shop was the same as in the aero-engine shop—good work cannot be done in bad surroundings. Great accuracy is a kind of tidiness. The sloppy fit accompanies sloppy conditions; neatness of workmanship requires neatness of mind, and neatness of mind demands in the workshop a sort of virile daintiness, the daintiness of a Carpentier, who knocks you out, indeed, but knocks you out artistically. There is a physchological effect behind it which defies clear definition. The men work better not only because their tools and instruments are clean, not only because the light is better, not only because there is freedom from dust, not only because there is a place for everything and everything is in its place, but because the neatness of their surroundings inspires a mental neatness. Years ago a wise Belgian engineer—Van den Kerchove, of Ghent—had noticed this phenomenon. His works, indeed, could not hold a candle to the works of to-day, but he was reaching out for the same effect. There was a surprising amount of polished steel and iron and brass in his engines. No one could say that there was any material value in the high polish put upon the edges of a governor-bracket, nor could one say that there was any practical necessity to polish connecting-rods till they glittered like the drops on a chandelier. But Van den Kerchove wanted the highest degree of accuracy—he was ahead of his time—and he knew that the best way to get it was to foster in his men a love of neatness. What was rare in those days—Willans was his only compeer here—is now commonplace. His limits of accuracy have been far exceeded and the number of applications multiplied a thousand times. Yet the same psychological effect goes on and accuracy of workmanship is still ensured by encouraging respect for general neatness and cleanliness. But, it will be asked, what has this to do with flowers in a boiler-shop? One does not ask for high accuracy in the making of boilers; they have not to be made to fine tolerances and finished to micrometer limits. True, but even they are better for closer attention to dimensions than is always given. In days not so long gone by standard boilers were made at Swindon. They were supposed to be interchangeable. Any boiler of a class might be lifted off the frames and—in theory—another boiler of the same class should drop into its place. But boilermakers had not then reached the conception of such accuracy of dimensions. There were gross departures from the standard sizes and actual interchangeability did not exist. Then Mr. Collett took a bold step. He made an engineer—instead of a boilermaker—manager of the boiler-shop. The engineer brought to boiler work unaccustomed views upon accuracy; but they prevailed, and now real interchangeability has been attained. And with the high degree of accuracy for boiler work that that implies, the dirty floor, the scattered plates and angles, the bad light, the smoky atmosphere have gone and flowers bloom upon the pillars.

Although we could name a score or so of British engineering works which have gone far towards an ideal of cleanliness and tidiness, we fear that, as yet, the improvement is no more than sporadic and that there are still many employers who do not see the value of it, and more managers and foremen who say it is impossible in the circumstances surrounding them. But we have little doubt that what is rare now will be common in a few years' time. For although we have laid stress upon the purely psychological effects induced by tidy surroundings, it must not be forgotten that it is good business as well. A shop that is cluttered up with materials is certain to be one in which the best management is lacking. The material is lying about because the machines are not ready for it, or because the various departments of the works are not marching in step. If route-ing is properly carried out, if shops do not undertake—by rash promises—more than they can perform, if the manufactured parts move steadily forwards to their appointed places at the appointed rate, then shop-tidiness is not difficult to attain. It is admitted by all experts in management that the properly timed sequence of operations is essential to economical working, and as that fact is more and more generally recognised and acted upon, so shall we see more and more works throwing off the dust and untidiness, both mental and material, of the past, and more and more frequently shall we see flowers—metaphorical or real—blooming inside our factories.

The Inspiration of Tradition.

BRISTOL is claimed by its inhabitants to present a blending of the old with the new to an extent which is unequalled by any city of the Empire, with the exception of London. That the claim has a very solid foundation will be conceded by all who met last week in the city on the occasion of the Institution of Mechanical Engineers' summer visit. The casual traveller is not immediately impressed

by Bristol on his arrival. Temple Meads railway station, in spite of its name, is neither poetic in appearance nor poetically situated. Within the bounds of the city there is much that is conspicuous and little that is picturesque about the river Avon, or, more precisely, the "Floating Harbour" and the "New Cut" formed from it in 1809. Significant of the city's modern activities, but destructive to its beauty, are the numerous power-houses, timber yards, tobacco warehouses and granaries which force themselves on the visitor's notice. The traveller must not, however, judge Bristol superficially. Hard behind the gasworks he will find the twelfth-century cathedral, the interior of which far surpasses the promise of the exterior. Across the river, in the drabest of surroundings, he will see the "fairest of all churches," St. Mary Redcliff, now happily ensured against the ravages of time. Looking elsewhere he will discover in almost every street some notable relic, some unexpected survival from the ages that are past. Given time and opportunity to study it, Bristol reveals itself not only as a city of contrasts, but as a community which has carried over into its modern activities the spirit of its early history. Its Merchant Venturers, as well as its ancient cathedral and churches, still survive. Fortunate, indeed, are those communities which, like Bristol, have a great past to inspire them in the present.

High over Bristol there stands a monument to John and Sebastian Cabot, for it was in a Bristol ship manned by Bristol sailors that these two, father and son, set forth in 1497 on the voyage which led to the discovery of North America. The centuries passed by, and in 1837 another epoch of ocean voyaging began at Bristol with the launching from Patterson's Yard on the Avon of the "Great Western," the pioneer of transatlantic steamship traffic. In 1843 the city saw the launching of the "Great Britain," the first ocean-going steamer to be built of iron and the first to be propelled by screw instead of paddles. The pioneering spirit still survives. To-day, not only has Bristol a famous aircraft manufacturing works within its confines and two others equally well known within its sphere of influence; it fittingly possesses a municipal air port which, it is believed, will become the centre for Irish aerial traffic and possibly for transatlantic air voyages. It is undoubtedly true that Bristol can look back on a certain period of its history with little pride—the period when its merchants and manufacturers grew rich on a trade based on slavery. Ships left the city with English goods which they bartered for slaves in Africa. The captives were carried to the West Indies, where the planters purchased them, giving in exchange sugar and other tropical products. The abolition of the slave trade in 1807 greatly affected the prosperity of the port. Indeed, for a number of years the enterprise of the inhabitants seemed to have largely disappeared. The spirit which permitted the traffic in human beings was rightly not allowed to survive. In its place there has grown up a characteristic of precisely the opposite tendency. Bristol to-day is surpassed by no city with which we are acquainted in the provision made by its employers for the comfort, well-being, and happiness of their workers. In no industry is the worker's welfare more sedulously and more successfully considered than in the tobacco and cocoa trades, two industries which in former times rested largely on slave labour. It may be said by the cynic that if slavery of the body has been abolished, slavery to the machine has been set up in its place. The suggestion does not bear invariably the impress of truth. The psychology of the modern factory worker is something which has not yet been fully expressed in print. The most monotonous repetition processes may be cheerfully undertaken without a desire for change, even when change is encouraged, if the factory surroundings are pleasant, and if facilities exist for the expression of the worker's personality outside factory hours. Among all the features of Bristol which attract the interest and admiration of the visitor the University is supreme—symbolically and in actual fact. Its tall tower, 200ft. in height, standing at the head of the steep incline known as Park-street, overtops all other structures in the city, and is the very expression of the factors which have made Bristol what it is. The University buildings are modern. They had, in fact, still to be completed when the war was ended. In design and craftsmanship, however, they rival and in many respects surpass the best examples of the ancient builder's skill and art which exist in these islands. Beautiful as is the neighbouring cathedral of Wells, impressively grand as Glastonbury Abbey must have been before time and vandalism brought it to ruins, the dignity and perfection of the University buildings survive comparison. Glastonbury Abbey is inseparably associated with the legend of St. Joseph of Arimathea and the Holy Grail. Wells Cathedral is unique in the completeness with which it preserves the workmanship of its thirteenth century builders. The University buildings, a memorial to Henry Overton Wills and no less a monument to their designer, Sir George Oatley, fit harmoniously into the picture. In spite of their modernity, they carry on the traditions of the past as surely as does Glastonbury. In their fabric they present a structure which should defy the ravages of time at least as successfully as the handiwork of the mediæval builders at Wells.

Right at the top of the University tower the energetic visitor will find "Great George," the ten-ton bell, the sonorous boom of which tells the time to Bristol and even to Bath. Here, as is only fitting, we find opportunity for a last contrast between ancient and modern, and the inspiration to high achievement which the conjunction of the two outlooks brings. At Wells there is to be found the remains of one of the earliest clocks made in England. It was constructed about 1335 by Peter Lightfoot, a monk of Glastonbury Abbey, and was transferred to Wells at the time of the dissolution of the monasteries. The old movement, removed in 1835, is now at South Kensington and is still capable of motion. At Wells the original dial is to be seen, and the doubtfully original knights in armour who each hour charge and unseat their opponents as in a tournament. Close at hand, too, is a large sitting figure which kicks two small bells with his feet at the quarter hours and hits another bell with a battle-axe as a "warning" at the hours. If these conceits are less elaborate than some to be found on the Continent, the old clock at Wells cannot do otherwise than impress the beholder with a sense of the loving workmanship bestowed on it by its originator. Precisely the same spirit, one is certain, inspired Professor David Robertson, when in 1924 he undertook the agreeable and interesting task, as he himself has called it, of designing an electrical machine for striking the hours on "Great George." A record of that task and of the details of the mechanism whereby it was accomplished exists. In nothing but in the spirit of the workman is there any connection with the clock of the mediæval monk. But in the union of spirits there is everything. Whether we be makers of clocks, the artificers of buildings, the manufacturers of aircraft, or the producers of ships, familiarity with the traditions of our predecessors, however differently they may have worked and however different their materials may have been, provides an impetus to high endeavour of a very direct value and importance to us in the world of to-day.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

"MISS ENGLAND'S" AND OTHER HIGH-SPEED PROPELLERS.

SIR,—During the short period that "Miss England II." was undergoing her general trials, and the tuning up for them at Windermere, the problem which faced the late Sir Henry Segrave was that of finding a suitable propeller with which he could drive the boat at the high speed necessary to break the record. His early experiences were rather disappointing, as each of the original steel propellers, although prepared and supplied for the purpose, had failed.

The writer was invited on June 7th to assist the late Sir Henry and Mr. F. Cooper, the boat designer, in solving the troubles which were manifest, with the result that orders were given for two two-bladed bronze propellers, to be followed by two propellers of high-chromium steel.

A provisional bronze propeller was made up and delivered on June 11th, with the object of ascertaining certain facts regarding the thrust to be contended with in the final design. This first propeller stood up to the work sufficiently to enable Sir Henry to make a set of trials and return under power. After examination of the propeller its appearance confirmed the possibility of heavy loading under the special conditions which applied in this case.

The second propeller, also of high-tensile bronze, was delivered on the morning of June 13th, and was used on "Miss England II." when the record was broken. A cursory examination of it before the boat sank showed that it was intact. After raising the boat a further examination took place. It showed that the propeller had suffered, owing to the grappling in the course of lifting "Miss England II." from the bottom of the lake. The condition of the surface of the propeller also suggested that the thrust required to drive her was greater than expected. However, a propeller of nickel-chrome steel, made to the same design as the bronze one used in the trial, would be quite capable of performing its duty without distress. The propeller was designed to absorb 3000 H.P., but there is no doubt that the actual power was nearly 4000. The total load upon the propeller may be safely estimated at 13,000 lb., roughly 6 tons. Had the customary surface pressure been adopted a propeller 4ft. in diameter would have been required, assuming, as was the case, that the projected surface was half the disc area.

The following general comments will no doubt be of interest to students of propellers and engineers in general.

It is not many years ago that speeds of 12 and 15 miles per hour were considered quite fast, but to-day a speed of over 100 miles per hour has been attained. Therefore, ideas regarding the limitations in propeller design of those early days may be reasonably reconsidered with the new information available to-day.

America had held the motor boat world's speed record for many years; Great Britain had already won the air record. Sir Henry Segrave, breaking the land record by the wonderful speed he attained with the "Golden Arrow," desired to wrest from America the world's record on water, and it was with that object that "Miss England II." was designed and built.

The results when he broke the record are public knowledge. They were as follows:—Speeds of 96·41 and 101·11 m.p.h. were attained in two runs observed by officials of the Marine Motoring Association, whose observations have been confirmed by the International Motor Yachting Union, the acknowledged authority for world's records. The third run was not completed, but an unofficial timing gave a speed of 119·8 m.p.h. for the distance covered—sufficient to prove that the boat was a triumph of British work and capable of beating the world's records with a substantial margin.

The internal combustion engines used in the boat produced by our leading engineers in that line were duplicates of the Schneider Cup engines, and similar engines had already secured the air record for Great Britain. The two engines of 2000 H.P. each, driving through a gear-box a single propeller shaft rotating at 10,000 r.p.m., had a power-weight ratio never previously deemed possible. By the use of such special propelling mechanism it was possible to engine a boat of extremely light weight, the complete unit having a power-weight ratio previously unequalled. All these factors assisted in achieving the phenomenal increase in speed of water-borne craft.

The propeller used in the world's record trial, when "Miss England II." actually travelled at over 100 miles per hour, was of special design. It had two blades and was only 16in. in diameter and was driven at 10,000 r.p.m. The primary object in using such an enormous propeller shaft speed was to reduce the torque reaction, a very important item when the high power of the engines is considered—3600 to 4000 B.H.P. being available to drive the vessel.

No previous propeller having been run at such a high number of revolutions per minute and being capable of absorbing such high power, or even one-half of the power, made the problem unique. However, by extrapolating a curve previously partially created from the figures obtained in the trials of other fast craft, with which the writer had been associated, the progressive value of the curve was ascertained.

The actual results confirmed the values of that curve, and now a new line of information is available regarding the functioning of high-speed propellers in high-speed boats, which information is quite revolutionary when compared with the accepted data as to the loading of propeller surfaces.

The subject of high speed, high revolutions and high pressures cannot be lightly dismissed, as it is interlocked with power-weight ratio and relative high boat speed. The late Lord Kelvin once stated: "If a horse could gallop at a speed sufficiently fast, it could gallop over the sea." The action of a seaplane float on the surface of the sea, and of the angular surfaces of the planes of a hydroplane on the water at speed is proof of Lord Kelvin's comment being correct.

All fast craft at speeds such as are now possible have to lift their water-borne surfaces from the displacement condition to the planing position, and by virtue of this alteration of displacement the propeller problem may be viewed from a new angle.

Many important items not previously evident are thus made prominent. For example:—

The angle of the propeller shaft relative to the line of travel.

Streamline of the blade section; 480 m.p.h. is the periphery speed of the blade tips—a rather impressive speed.

Stress due to centrifugal force, brought about by the extraordinary high shaft speed, requires special attention to prevent the blades parting from the boss, the actual figure being 16,000 lb. per pound of blade weight, taken at a radius of 6in.

These considerations, together with the necessary provision of strength in the blade form and root, to withstand the excessive thrust necessary to drive such a vessel at the record speed, calls for very careful design.

Advantages of high revolutions are not merely in the propeller efficiency, but of a secondary character, *i.e.*, high shaft speed allows the use of a propeller of smaller diameter with a corresponding reduction in the size of the supporting brackets, which in turn reduces the drag due to such parts through the water. There is less torque reaction and the parts used can be of less weight.

Summing up the general points. Whilst the foregoing deals with the high-speed type of propeller, all propellers are worthy of a little more consideration than they have hitherto received.

The subject of boat propulsion is one which must embrace

L.M.S. RAILWAY.—NEW "ROYAL SCOT" EXPRESS TRAIN

FIG. 1—THIRD-CLASS COMPARTMENT

FIG. 2—FIRST-CLASS COMPARTMENT

all the essentials, the propeller being the most important, inasmuch as the whole scheme is centred upon it.

Some recent examples have shown that by special attention to blade form, proportions, general finish, and, not the least important, the care in balancing both statically and dynamically, increases of boat speed of 5 to 15 per cent. have been possible without any additional power being required. Several of these results were attained on medium-speed craft.

These experiences prove that some form of co-operative research is really necessary for the advancement of the essential detail in our marine industry.

The whole subject of propeller design has been so very seriously involved in the effort made by the late Sir Henry Segrave, in his successful endeavours to break the world's record, that in the opinion of the writer the finest and most useful form of memorial tribute to the service rendered to the cause in which he lost his life would be to form a fund for research on propellers and propulsion as related to high-speed craft, and he suggests that it should be called the "Segrave's Memorial Research Fund."

July 5th. F. BAMFORD.

STEEL-FRAMED BUILDINGS.

SIR,—I was very interested to read in your issue of June 27th that questions had been asked in Parliament regarding standardisation of regulations for steel-framed buildings. It is to be hoped, however, that such standardisation will not result merely in the perpetuation of what is already patently absurd.

For example, it is well known from standard works on mechanics that a true fixed-ended stanchion of length L consists virtually of a centre pin-ended stanchion of length ½ L, plus two end cantilever stanchions of length ¼ L. On reference to the stanchion formulæ which the London County Council at present has power to enforce upon structural engineers, it will be found that the allowable stress for a fixed-ended stanchion is given by $6 \cdot 5 - l/40\,r$ tons per square inch; and for a pin-ended stanchion by $4 \cdot 5 - l/40\,r$ tons per square inch, where l is the total length and r the radius of gyration.

It is thus discovered that the allowable stress for a fixed-ended stanchion whose $l/r = 80$ is 4·5 tons per square inch and that the allowable stress for the pin-ended stanchion of $l/r = 40$, constituting its middle length, is only 3·5 tons per square inch, a result which is clearly absurd, since the stanchion as a whole cannot possibly support a given load at its ends when its centre has already collapsed under a smaller load. For shorter lengths the discrepancy is accentuated, and the legitimate assumption that true fixity of ends may not be allowed for, merely makes confusion worse confounded.

Such an absurdity in stanchion regulations strikes at the very root of intelligent stanchion analysis and design; the firm which submits careful calculations showing pin-end points of inflexion in compression members is held down to a maximum stress of 4·5 tons per square inch, no matter how short the members may be; while the ignorant contractor who is unaware of what a point of inflexion is gets away with 6·5 tons per square inch as a "fixed-ended stanchion."

It would appear that the anomaly would be obvious to those in authority, but the fact that the L.C.C. re-issued these formulæ in 1928 without alteration shows that this is not the case, and, to make matters worse, the same formulæ are being officially adopted and enforced by other towns throughout the country, notably Liverpool Corporation, on the precedent of the London Building Acts.

Not only are the formulæ absurd for pure stanchions, but in the case of combined thrust and bending they are quite impossible. For instance, if a member is vertical it is looked upon officially as a "stanchion or pillar with bending," and the combined stress is limited to the stanchion stress. If, however, the same member is horizontal, it is looked upon as a "girder with end thrust," and may be stressed to 7½ tons per square inch under the same conditions, the whole point turning upon whether the word "stanchion" or "girder" is used in the calculations, since no intermediate condition is recognised.

As we are now building super-power stations of steel to enable us to hold our place in the world's trade, the sooner these illogical and antiquated regulations are removed the better for British engineering, and it is to be hoped that engineers throughout the country will see that the new regulations are at least logical throughout, whether applied to stanchions, girders, compression flanges or tension members or to any combination of loadings and twistings whatever. Their quantitative correctness can then be checked and compared by experiment as years go on, and the regulations periodically reviewed and brought up to date until they become a reliable guide to design instead of an illogical contradiction of engineering principles. There is no use improving efficiency of transport and steel works plant and spending money on training engineers when all good results are negatived by compulsory bad design.

Redhill, July 9th. J. A. G. SMITH.

New Twin "Royal Scot" Expresses.

COMMENCING with the summer train service, which came into operation on Monday, July 7th, the L.M.S. Railway Company is putting into service two trains composed of stock of an entirely new design. Each of them is made up of fourteen vehicles. The total length is 846ft. and the weight 412 tons without the engine. The complete train is in two parts, one for Glasgow with eight vehicles, the other for Edinburgh with six. There is a kitchen car in each part. The Glasgow portion weighs 235 tons and accommodates 46 first and 168 third-class passengers; the Edinburgh portion weighs 177 tons and carries 62 first and 84 third-class passengers. A special feature of the vehicles is the elimination of the waist line, which makes it possible to include both deeper and wider windows, affording better observation—see Fig. 1. The windows are of the balanced type and can be opened or closed with the minimum of effort. By dispensing with the waist line it has also been possible for more steel to be absorbed in the construction than is usual in rail cars, rendering the vehicles more fireproof and adding to their strength. The usual intercommunication is provided throughout the train by means of gangways. There is accommodation for 108 first-class and 252 third-class passengers. All seats are numbered throughout the train for the purpose of seat reservation.

The interior panels of the first-class dining saloon are of rare Indian greywood, the seats being upholstered in an old Persian design moquette. There is ample accommodation for light luggage and the saloon is carpeted throughout. The first-class corridor compartments are finished in old English oak, Indian greywood and mahogany.

The interior of the first-class corridor brake car has been designed with three similar compartments to those in the first-class corridor vestibule. The corridor, which links all the various compartments, has Westinghouse heaters built in the walls of the cars and concealed by flush metal covers, harmonising with the other metal fittings. The carriages are electrically lighted from the ceiling, and ventilation without draught has received careful consideration, and each compartment is equipped with a "Dewel" ventilator which is easily controlled by a handle on the window sill.

The finishing in the third-class vestibule and corridor cars is of polished mahogany. The seats are upholstered in Persian and other variously designed moquettes, and the brasswork is finished in Venetian bronze. The third-class compartments, like the first-class—see Fig. 2—are fitted with double sliding doors so that the passenger sitting on the corridor side will have as good a window outlook as the passenger sitting on the body side of the car.

The kitchen cars are equipped with the most modern culinary appointments, and as the car is a self-contained unit, the odours arising from cooking are not conveyed to the passenger vehicles.

The guards' van at the end of the train is of a new all-steel type and specially fitted with tools and fire extinguishers for use in emergency.

These vehicles have been designed by Mr. E. J. H. Lemon, carriage and wagon superintendent of the L.M. and S. Railway.

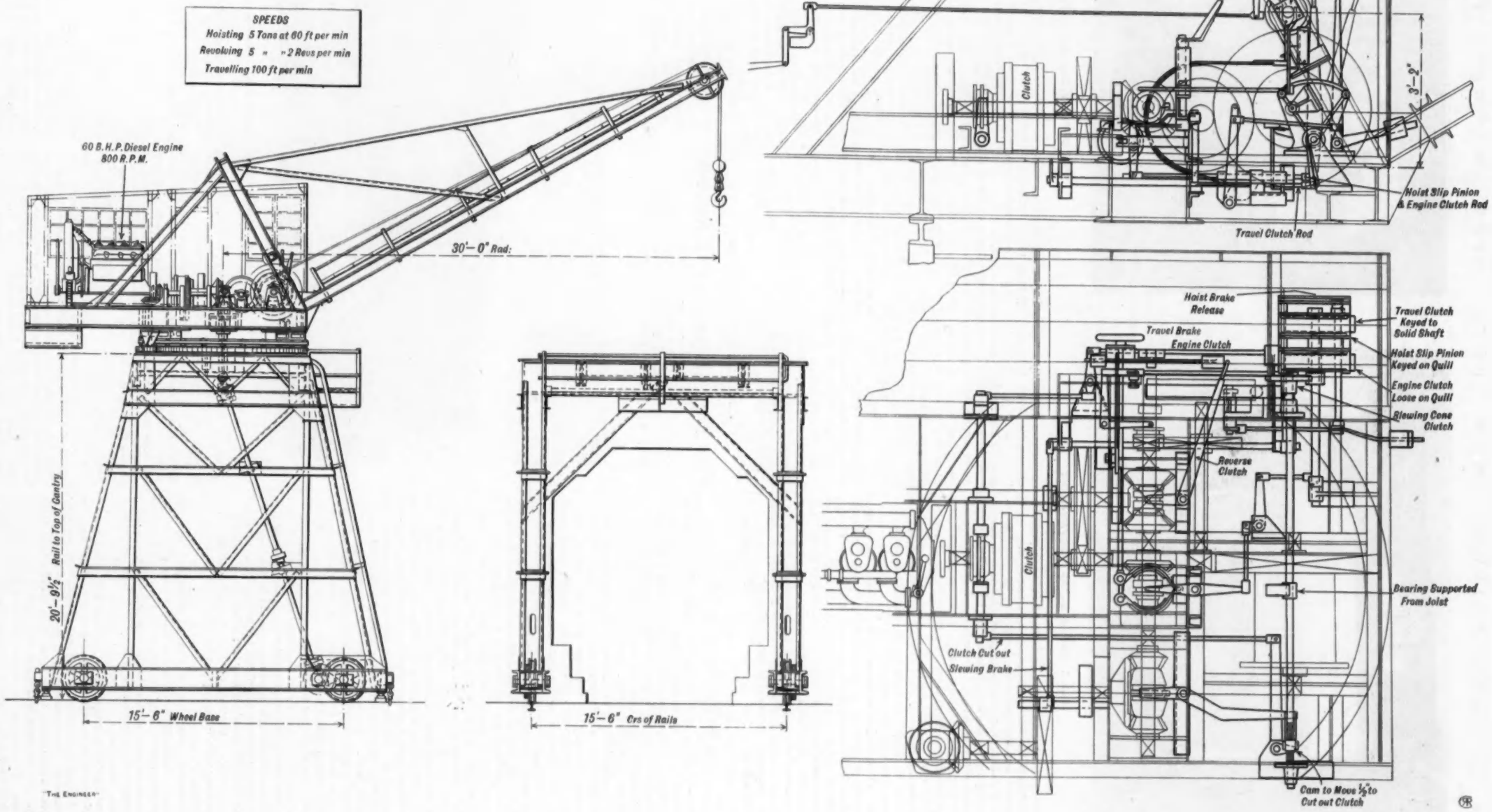
FIG. 3—THIRD-CLASS VESTIBULE COACH

THE London, Midland and Scottish engine No. 6123, which bears the name "Royal Irish Fusilier," has been presented with two plaques bearing the crest of that regiment with its legend "Faugh-a-Ballagh" ("Clear the Way"). They were presented by Lieut.-General T. E. Scott, Officer Commanding the Royal Irish Fusiliers, and accepted by Mr. John Quirey, one of the vice-presidents, for the railway traffic operation and the commercial section.

OIL-ENGINE DRIVEN PORTAL CRANE

JOSEPH BOOTH AND BROTHERS, LTD., RODLEY, ENGINEERS

(*For description see opposite page.*).


SPEEDS
Hoisting 5 Tons at 60 ft per min
Revolving 5 " " 2 Revs per min
Travelling 100 ft per min
60 B.H.P. Diesel Engine 800 R.P.M.
30'-0" Rad:
20'-9½" Rail to Top of Gantry
15'-6" Wheel Base
15'-6" Crs of Rails
Clutch
3'-2"
Hoist Slip Pinion & Engine Clutch Rod
Travel Clutch Rod
Hoist Brake Release
Travel Brake Engine Clutch
Travel Clutch Keyed to Solid Shaft
Hoist Slip Pinion Keyed on Quill
Engine Clutch Loose on Quill
Slewing Cone Clutch
Reverse Clutch
Clutch
Bearing Supported From Joist
Clutch Cut out
Slewing Brake
Cam to Move ½" to Cut out Clutch

"THE ENGINEER"

ENGINE AND CONTROL GEAR OF PORTAL CRANE

Five-Ton Portal Crane Operated by an Oil Engine.

THERE has recently been constructed at the works of Joseph Booth and Bros., Ltd., Rodley, near Leeds, for the Entre Rios Railways Company, Ltd., an interesting portal crane for dockside work. The crane is designed to deal with loads up to 5 tons, and the special feature of the crane is that all the motions are operated by a 60 horse-power McLaren-Benz oil engine of the airless injection type. Illustrations of the crane are given herewith from which it will be noted that hoisting, travelling, and revolving motions are provided, the radius being fixed at 30ft. The carriage runs on a 15ft. 6in. gauge, with a wheel base of similar dimensions, and straddles a 4ft. 8½in. railway track.

CRANE ERECTED IN MAKERS' YARD

The superstructure revolves on a cast steel roller path fitted with live rollers and the outside rim of the path forms the rack for engaging with the slewing motion. To give increased stability the engine is mounted on the centre line of the superstructure towards the rear. The engine is of the four-cylinder vertical pattern and is started by means of a V-twin 8 horse-power Jap petrol engine. The Benz engine, starting engine and radiator are all carried on two longitudinal steel channels which are continued forward and carry the bearings for the clutch and first-drive pinion, thus ensuring correct alignment. The fuel tank is mounted over the fly-wheel and has two compartments, one for Diesel oil, which is fed to the engine for starting, and the other for heavier oil on which the engine continues to operate after acquiring the necessary heat.

When designing the crane special consideration had to be given to the method of starting and stopping the drive, as, unlike steam and electrically operated cranes, the prime mover is running continuously and is non-reversible. Moreover, as the engine has only a comparatively small range of speed it was necessary to make special provision for running the various motions of the crane dead slow when necessary. The latter effect is obtained by the use of a Hele Shaw clutch, which has been found to give excellent results, it being possible to operate any motion to fractions of an inch by allowing the clutch to slip. This clutch, as will be noted from the drawings, is fitted directly in front of the fly-wheel, and from it the drive is taken by means of a single spur reduction through the bevel gear reversing box to the main cross shaft. On this cross shaft are mounted the clutches and gears for driving the different motions. For hoisting operations there are two gear reductions between the cross shaft and the main barrel. The hoisting motion is engaged with the cross shaft by means of a slip pinion and the brake drum is fitted to the second motion shaft. The brake is of the band type lined with Ferodo and is arranged so that it is normally in the "on" position. The brake drum is fitted with a ratchet gear so that it does not revolve when hoisting, and it is necessary to release the brake before lowering. From the drawing on page 44, it will be seen that there is a quick-threaded screw on the end of the main hoisting barrel, and a nut on this screw engages with a lever which can be set to knock out the main clutch at a predetermined point to prevent accidental overwinding. The slewing motion is operated by double friction cones on the cross shaft, so that the motion can be run in either direction independently of the direction in which the cross shaft is revolving. The travelling motion is engaged by means of a dog clutch operating on the cross shaft.

To give the crane driver an uninterrupted view of the load the controls have all been grouped on the front left-hand side of the cabin. The main clutch, hoist, travelling, and hoist brake are worked by hand levers in a quadrant immediately in front of the driver. The slewing motion and travelling brakes are operated by hand wheels and the slewing brake and cross shaft check brake by foot levers. The purpose of the check brake requires some explanation. It was found that when cold the main clutch has a tendency to drag and the brake has to be applied to stop the shaft from revolving when engaging the gears, but the same brake may also be used in an emergency for any of the other motions.

The crane has been constructed from the specification of the consulting engineers, Messrs. Livesey, Son and Henderson.

Low-Pressure High-Speed Oil-Engine.

IN the course of the discussion which took place on high-speed heavy oil engines for road transport service, at the recent World Power Conference held at Berlin, several speakers referred to the new low-pressure oil engine utilising non-volatile fuels, which has been invented and developed by Mr. K. J. E. Hesselman, of Stockholm. The principal feature of this new engine is that, while working with a low compression and ignition pressure and using non-volatile fuels, it retains the ordinary spark ignition and many features of the normal petrol engine construction, but the principle employed enables heavy oils to be used with a considerable saving in the cost of fuel. The Hesselman engine has been built and subjected to extended test bench and road trials in Stockholm and has also been successfully put to work in a motor cruiser. Under agreement with Oil Motors, Ltd., of 56, Kingsway, London, W.C. 2, and Stockholm, successful experimental engines have also been constructed and run at the Grazer Waggonfabrik at Graz, Austria, and at the Leyland Works of Leyland Motors, Ltd., of Preston, Lancashire. In what follows a description of the new engine is given, together with typical performance results.

THE WORKING PRINCIPLE.

When beginning his research work, Mr. Hesselman started from his original designs for the slower-speed airless injection Diesel oil engines which are associated with his name. In taking up the light high-speed engine he early decided, however, to discard the high-compression principle with its necessity for heavy scantlings and its inherent more difficult starting problems, and to work on the low-pressure principle, retaining the ordinary spark ignition of the petrol engine, along with the airless injection

of the fuel in a finely divided state. In order to effect a thorough mixture of the fuel with the suction air a rotary motion was imparted to the incoming air by a shield on the inlet valve, which causes it to swirl around the deep recess formed by the hollowed piston crown. The air fuel mixture was thus caused to pass before the shielded points of the sparking plug, which itself does not come into direct contact with the fuel spray. In order to obtain smokeless operation, especially at light loads or when idling, the amount of air delivered to the cylinder was varied with the spring-loaded throttle valve worked by the lever which operates the fuel pump control shaft.

THE FUEL PUMP UNIT.

One of the most important features of the engine is the fuel pump, an enlarged view of which is reproduced in Fig. 3. As shown in Figs. 1 and 3, the fuel pump body is constructed in one piece along with the casing for the spray nozzle. By means of the staggered delivery canal the minimum depth from the centre of the spray nozzle the fuel pump plunger is surrounded by an adjustable casing which, when screwed up, as shown in the right-hand view reproduced in Fig. 5, brings the end of the plunger quite clear of the valve lifter and the control tappet, thus enabling each pump unit to be inspected and dismantled without altering in any way the control settings for the other cylinders. The left-hand view in the same illustration shows the plunger and control tappet in the light load position. The amount of fuel injected into the cylinder is regulated partly by the control tappet attached to a shaft

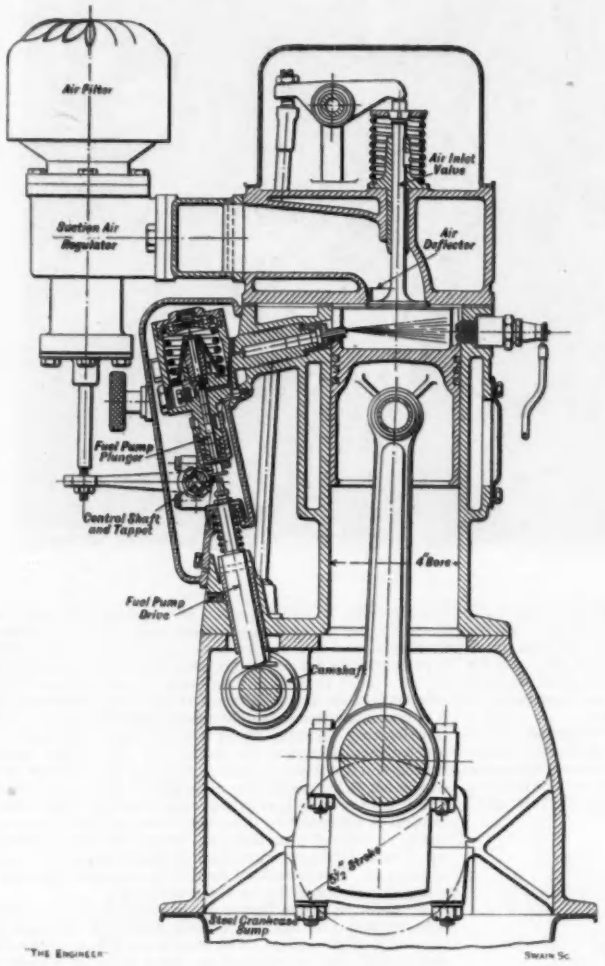


FIG. 1—SECTION OF ENGINE THROUGH FUEL PUMP

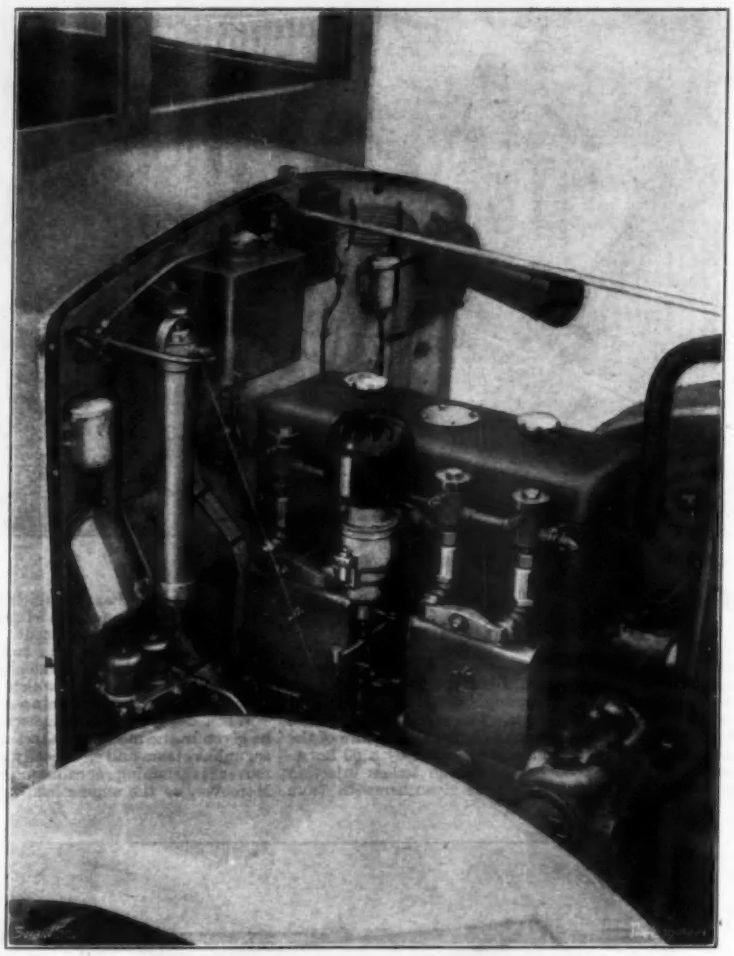


FIG. 2—ENGINE INSTALLED IN MOTOR LORRY

load by regulating the suction air. Special attention was also given to the spraying of the fuel and the point of cut-off so that no dribbling can take place. In Fig. 1 we illustrate a typical design of Hesselman automobile or motor boat engine, and in Fig. 2 we give a view of a standard four-cylinder Scania-Vabis petrol engine which has been modified to embody the Hesselman system of operation. It is shown installed in a 3-ton lorry chassis. An interesting feature of the Hesselman design is the ease with which a standard petrol motor may be adapted and worked with non-volatile fuels without danger of overloading or undue stressing of any working part. Naturally, however, in an engine specially designed for the Hesselman system a slightly more convenient arrangement of details can be made. Such an engine is shown in Fig. 1.

GENERAL CONSTRUCTION.

We need hardly refer to the engine bed-plate, crank and cylinder casings, cylinder cover and valves, and the reciprocating parts, which are of practically normal construction. Particular interest attaches, however, to the special shape of the piston head, the arrangement of the sparking plug and the fuel spray nozzle, the driving and regulation of the fuel pump, and the means adopted to control the volume of suction air. As Fig. 1 indicates, the sparking plug is arranged diametrically opposite to the fuel spray nozzle, but the plug points are effectively screened by the slot cut in the upper wall of the piston crown. A similar slot is provided for the fuel spray nozzle. No actual fuel touches the plug, as the two horizontal sprays which are conical in form are set each at an angle of 30 deg. to the common axis of the plug and the spray nozzle. The deep hollow crown is designed effectively to prevent any fuel from being deposited on the walls of the cylinder and thus interfering with the normal lubrication of the liner. As will be seen from the drawing, the spindle of the air inlet valve is positioned by a snug so that the semi-circular shield attached to the upper side of the inlet valve head gives a definite rotary motion to the entering air. The effect of this motion on the fuel mixture is indicated diagrammatically in Fig. 4. Although there are really two fuel sprays, only one of them has been indicated in the drawing, so as to make the direction of the air deflection more clear. It will be noted that at full load practically the whole of the piston area is charged with fuel mixture, which is swept past the points of the sparking plug; but at light loads only a part of the area is charged with fuel, and with the smaller supply of air the readily ignitable mixture is in like manner caused to pass in front of the ignition plug, which plug, we noted, was of the three-point hot-spark type. As is shown in Fig. 1, the air regulator is combined with a filter unit and it consists of a

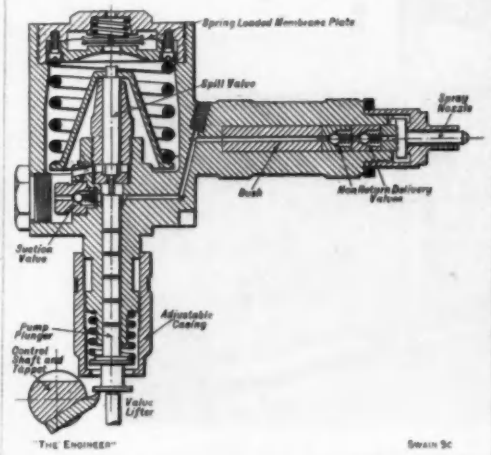


FIG. 3—FUEL PUMP AND SPRAY NOZZLE

to the bottom of the pump plunger is obtained. Although the pumps shown in our illustration differ slightly in detail, they all operate in the same manner. They are driven by a spring-loaded push rod or lifter, which is operated from the main cam shaft placed within the crank case. The upper part of the lifter is furnished with a cowl, which is designed to prevent fuel oil from finding its way into the crank case sump and thereby diluting the lubricating oil. The result of careful tests has, we understand, shown that in no case has there been any dilution which has detrimentally affected the working of the engine.

Both the suction and the two non-return delivery valves consist of hardened steel balls which lie on a hardened and ground conical seating, the springs being suitably chosen for the desired opening pressures. On either side of the delivery valves, as shown above, there are two bushes, which are only provided in order to obviate the drilling of long narrow bore passages. The spray nozzle itself is secured by a removable nut and the joint between the pump and the cylinder casing is made by a copper ring, the two adjacent pump units being held in position by a steel bridge piece, as illustrated in Fig. 2. The lower part of operated by the acceleration pedal, which also works the air regulator and varies the suction stroke of the pump, and partly by the push rod which, when the plunger reaches the end of its stroke, lifts the spill valve and releases the pressure on the delivery canal, thereby causing the spray instantly to cease without any dribbling effect. The spill valve is loaded with a strong spring so that it will not open at maximum fuel pump pressure, but is only opened when the valve is lifted clear of its seat by the fuel pump plunger at the end of its stroke. In order to prevent vibration and pulsations within the fuel pump owing to the quick starting and stopping of the flow, a spring-loaded membrane plate is fitted at the top of the pump, as shown in Fig. 3, which renders it quiet in operation. We were able to inspect in the Stockholm laboratory a fuel pump and spray nozzle unit which had been specially mounted so that it could be driven in a lathe, arrangements being also made to vary the amount of fuel delivered by the pump. At high speeds and also when operated by hand by pulling round the belt there appeared to be very fine atomisation of fuel, even when very small quantities of fuel were being delivered under conditions approaching to idling and light load running.

When fitted in the chassis of a lorry or car a small auxiliary fuel pump is provided in order to deliver the fuel to the suction side of the pump under a low head. An arrangement is provided whereby any air bubbles can escape and a filler is also included in the circuit. As will be noted from our illustration, the fuel pumps are totally enclosed by a light aluminium casing which can be easily removed for pump inspection.

In order to start the engine a small magnetically operated membrane pump worked from the car battery circuit is employed to prime the engine by introducing a few drops of petrol into the suction inlet. This being done, the engine starts immediately and can be run up to speed with the starting motor or cranked up by hand. As soon as the petrol is ignited the fuel charge also ignites and no dependence need be placed on the petrol for warming up the engine. In actual service a small tank holding from 1 to 2 litres of petrol has been found to be sufficient for long periods of running. We ourselves witnessed the immediate starting of a lorry from cold in the manner above described.

TEST BENCH AND ROAD TRIALS.

On the test bed in the Stockholm laboratory of Hesselman's Patents A.B. we inspected a four-cylinder Hesselman engine of the Scania-Vabis type with cylinders 100 mm. bore and 136 mm. stroke. The engine was running on a light gas oil and was operating with a clear exhaust. By adjusting the fuel supplies the engine ran at speeds down to 500 r.p.m., at which it idled with regular firing strokes.

The load was again put on and the speed was increased to 2400 r.p.m. with very steady running. Under all conditions there was a remarkable absence of smoke in the exhaust, only a slight puff of white smoke being noted when the supply of fuel was suddenly increased, which unclearness immediately passed away.

In order to test this engine with various fuels a series of

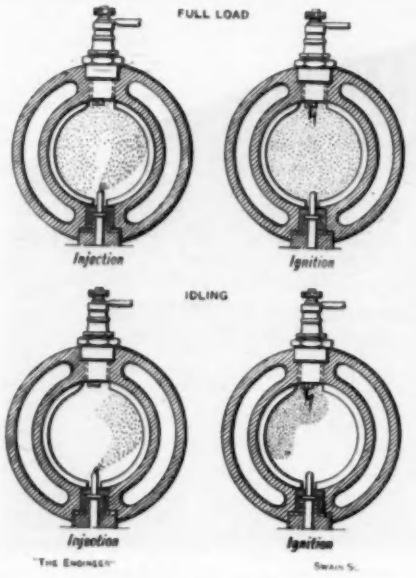


FIG. 4—FUEL DISTRIBUTION DIAGRAMS

trials was carried out with three different fuels, particulars of which are given in the following table :—

Fuel Particulars.

No. of trial	I.	II.	III.
Type of fuel	"Galisol"	Light Disoleum	"Gas oil,"
Supplier	Pratts	Anglo-Persian	Anglo-Persian
Specific gravity	0·856	0·876	0·871
Closed flash point, deg. Cent.	76	89	75
Hard asphalt	No trace	0·12	Trace
Ash, per cent.	0·01	0·003	Trace
Higher calorific value, kilo-calories	10,890	10,900	10,760
Lower calorific value, kilo-calories	10,190	10,200	10,060

The curves reproduced in Fig. 6 show the brake horse-power output, the fuel consumption, and the mean effective pressure in kilogrammes per square centimetre as plotted on a base of revolutions per minute. The curves shown in Fig. 7 are plotted on a base of average mean effective pressures in atmospheres and show the fuel consumption, the output and the variations in compression and ignition pressures. The low compression pressures and very moderate ignition pressures may be noted.

In the case of the high-speed, high-compression engine of the Diesel type a compression pressure of 40 kilos. per square centimetre, with a probable maximum pressure of 60 kilos. per square centimetre gives a mean effective pressure of 7·2 kilos. per square centimetre with a thermal efficiency of 30 to 33 per cent. For the Hesselman engine working with a compression pressure of 8 kilos. per square centimetre and a maximum pressure of 30 kilos. per square centimetre the same mean effective pressure of 7·2 kilos. per square centimetre has been obtained with a thermal efficiency of 30 per cent., which is an interesting and very satisfactory result.

We were able to take part in road runs both on the open roads around Stockholm and the busy streets of the city, and the vehicle, which was a 3-ton lorry fitted with an engine of the type we have above referred to, behaved

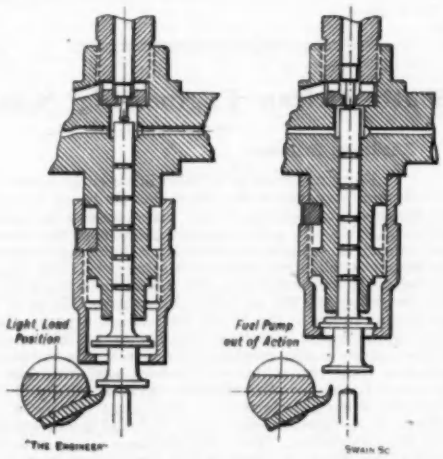


FIG. 5—FUEL PUMP ADJUSTING ARRANGEMENTS

extremely well under all conditions of operation. The engine was easy to drive and picked up well, and we could not detect any smell of fuel oil, nor was any smoky exhaust visible. We also examined a similar engine installed in a motor cruiser, which ran very smoothly and economically with no noticeable smell. Another Hesselman engine has been put into one of the standard vehicles of the Stockholm Bus Company and in service it has given, we learned, most satisfactory and economical results. At the present time the construction of a further series of omnibuses with engines of the same type is under consideration.

In an article by Professor E. Hubendick, of Stockholm, which appears in the Swedish technical journal *Teknisk Tidskrift*, detailed reference is made to a series of tests made at the Stockholm Motor Car Testing Institute with the 3-ton Scania-Vabis lorry already referred to. The standard petrol engine was first tested, and this was then exchanged with an engine of the same cylinder dimensions which had been modified to use fuel oil on the Hesselman system. The petrol engine was provided with a Scania type carburetter with a special regulator in order to obtain the most economical fuel-air mixture and with both engines a speed of 1000 r.p.m. corresponded to a road speed of 24 kiloms. per hour. For these comparative tests "Galisol" fuel of the type mentioned in the above table

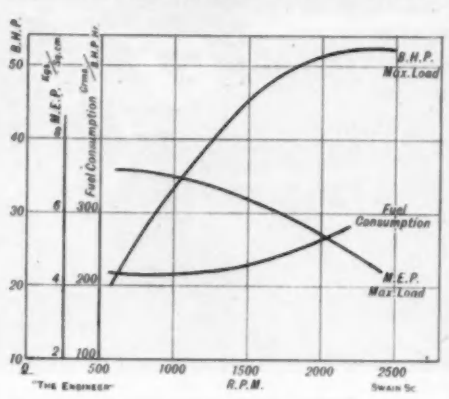


FIG. 6—OUTPUT AND FUEL CONSUMPTION

was used. The test results which we have examined and which included road and laboratory tests showed that the maximum mean effective pressure developed by the two engines was approximately the same when operated with petrol and with fuel oil. There was an economy of 20 to 25 per cent. in the amount of fuel needed when using fuel oil, and, taking into account the difference in the cost of fuels, which for Sweden are 1.5d. per litre for "Galisol" and 3.6d. per litre for petrol, the combined saving in fuel and the cheaper fuel oil results in an overall saving in fuel cost at full power of 68 per cent., which figure has been confirmed by Austrian road tests.

The future development of the low-pressure Hesselman type of engine for land and water transport will be awaited with considerable interest, especially as it affects Great Britain and the Colonies. As already mentioned, an experimental engine has been built and tested at the Leyland Works of Leyland Motors, Ltd., and has, we are given to understand, given satisfactory results, which compare well with the test figures obtained from the

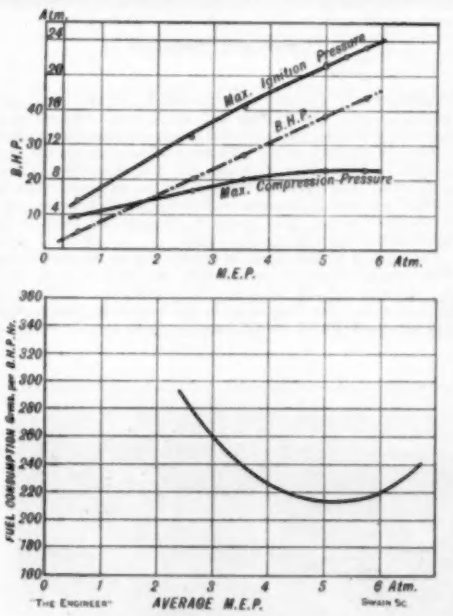


FIG. 7—PRESSURE CURVES

Swedish and Austrian-built engines. The new engine certainly possesses favourable features in the matters of simplicity and cost of construction alongside the small high-speed Diesel engine, while compared with the petrol engine the economy in fuel and the increased safety of operation are evident. It is generally agreed that there is a definite need to broaden the range of fuels which can be economically used in transport vehicles, and with any great extension of the use of non-volatile fuels such as are employed in the Hesselman type of engine it seems likely that a profitable market for Scotch shale oils and other British produced fuels might again be created, thus reviving our British fuel-producing industry.

ON the recommendation of a special committee Mr. T. Peirson Frank has been appointed as chief engineer of the London County Council at a commencing salary of £3000 a year. Mr. Frank, who is 44 years of age, has been city engineer at Liverpool for the past four years.

SIXTY YEARS AGO.

THERE is little in our issue of July 15th, 1870, that is likely to interest the modern reader. No one subject stands out prominently, although, from the different articles, we may extract a few notes of a miscellaneous nature. The Society of Engineers had recently visited Chatham Dockyard for the purpose of inspecting the extension then in progress. The work was being carried out by 1377 convicts and 232 free men. The convicts performed well and on occasion surpassed the workmanship of outside contractors' men. The Working Men's International Exhibition was to be opened on the following day at the Agricultural Hall, Islington, by the Prince of Wales. We had paid it a preliminary visit earlier in the week. It would appear to have been something of an inventor's exhibition confined to the "working classes." From Paris wonderful stories were being received concerning the capabilities of the French mitrailleuses. On one day two of the guns were fired on a group of 300 worn-out horses at a range of 1¼ miles. In less than three minutes all the horses were killed. Next day 500 horses were similarly slaughtered in a minute and a half. The story, it was suggested, was being promulgated in order to impress the Prussians. It was pointed out that the French mitrailleuse was generally supposed to have little or no effect at ranges beyond 1000 yards. The war was about to break out and manufacturers in this country, as our market reports showed, were already anxious about the situation and how its developments might affect their business. Mr. (Sir Edward) Reed had at last resigned from the office of Chief Constructor of the Navy and had joined the staff of Sir Joseph Whitworth and Co. His colleague at the Admiralty, Sir Spencer Robinson, the Controller of the Navy, still remained at his post, although it was commonly reported that he had sent in his resignation simultaneously with Mr. Reed's. In a leading article we dealt with the pollution of rivers and streams by factories and sewage, a subject which a report by the Rivers Pollution Commissioners had recently brought prominently before the public. We argued that a sweeping Act forbidding the discharge of any refuse matter into a river was urgently required. The evidence accumulated by the Commissioners pointed to the widespread contamination of river waters with arsenic. It was stated that 140 gallons of the water of the Kinder Brook in Derbyshire contained enough arseniate of soda to constitute an instantly fatal dose. The presence of the arsenic was traced to the fact that sulphuric acid as used in many factories was no longer made from Sicilian sulphur, but from iron pyrites containing arsenic. It was calculated that 1600 tons of arsenic were annually imported into this country in iron pyrites and that the greater proportion of that quantity eventually found its way into our rivers.

The name of the American army officer referred to in our note last week should have been Bonneville and not Bourneville as misprinted.

SYDNEY HARBOUR BRIDGE.

ON page 40 we give three views, additional to the two published in last week's issue, illustrating the state of erection on a recent date of the Sydney Harbour Bridge. The bridge, it will be gathered, is being erected simultaneously from the two shores. The material, as it is required, is hoisted up from the barges on the waterway below by means of a crane equipment, which, as erection proceeds, is advanced along the upper booms of the main girders. As we stated last week, the crane equipment was fully described in our issue of October 28th, 1927.

B.E.S.A. SPECIFICATIONS.

BRITISH STANDARD CONVERSION TABLES.

THE British Engineering Standards Association has recently issued comprehensive Tables of Conversions of inches to millimetres and millimetres to inches, covering both fractional and decimal subdivisions of an inch and giving the conversions to the various degrees of accuracy mostly used in the classes of work coming within the scope of the Association. The tables of inches and fractional subdivisions of an inch give the conversions of every $^1/_{64}$th of an inch up to and including 12in., whilst those for inch measurements in the decimal system give the conversions of every $^1/_{1000}$th of an inch up to 1in. The table of conversions of millimetres to inches gives the conversion of every millimetre from 1 to 1000.

Included in the publication is a table giving conversion factors for linear, square and cubic measures, weights, stresses, pressures and weights per unit length, for various measures common in engineering.

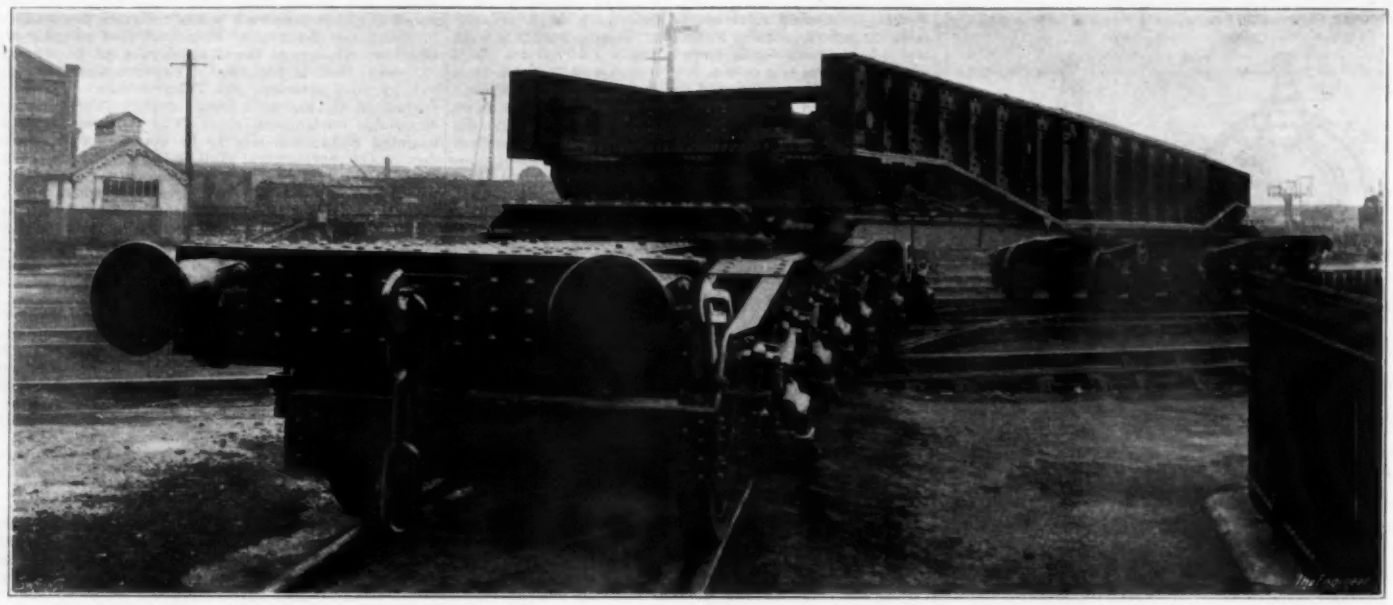
The greatest care has been taken to ensure accuracy in the published figures. They have been checked by the National Physical Laboratory and the publication is printed from stereotype plates so that there may be no risk or errors resulting from displacement of type. It is felt, therefore, that the tables may be used with every confidence, and that they will provide a valuable addition to the reference books of every engineering office which has occasion to use the metric and British systems.

Copies of these Tables, No. 350–1930, may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria-street, London, S.W. 1, price 2s. 2d. post free.

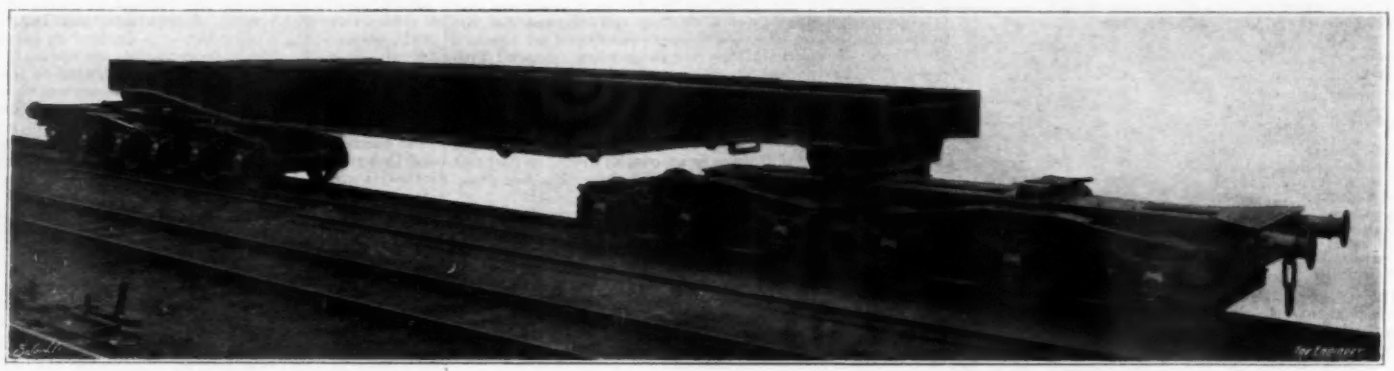
SPECIFICATION FOR THE PERFORMANCE OF DESK-TYPE ELECTRIC FANS (No. 380–1930).

THE British Engineering Standards Association has just issued a new specification, No. 380, for the Performance of Desk-type Electric Fans. This is a companion specification to No. 367, Ceiling Fans, and deals with the performance of the small-diameter high-speed propeller type of fan. The specification defines certain features of desk-type fans which relate to their performance and gives tests by which the performance may be ascertained. Dielectric tests and limits of temperature-rise are also given. Copies of the new specification can be obtained from the Association's Publication Department, price 2s. 2d. post free.

G.W.R.—120-TON RAILWAY TROLLEY



TROLLEY ON A SHARP CURVE



COMPLETE TROLLEY

120-Ton Railway Trolley.

To meet the requirements of the Central Electricity Board the G.W.R. Company has designed and built a special trolley at Swindon for the conveyance of transformers and like loads up to 120 tons in weight and 24ft. in length. In order to carry transformers with maximum possible dimensions it was decided, after consultation with electrical transformer manufacturers, to build a wagon in such a way that the transformers could be carried on brackets provided on their sides for the purpose. This arrangement made it possible to maintain the full width at the bottom of the transformer instead of restricting it at this point, as it would have to be if carried on a well-type trolley. To facilitate handling of such loads it was necessary so to design the truck that the side beams could be removed.

The two main girders which carry the load are supported at the ends by swivelling cross bolsters, to which are attached the top halves of cast steel main pivots and side bearings. The bottom halves of the main pivots and side bearings are bolted to supplementary frames, each of which transfers the load to two six-wheel bogies fitted at the centres with auxiliary pivots and side bearings. The supplementary frames are extended beyond the outer bogies to carry the buffing and draw gear. Between the ends of the main girders special bracing frames are securely riveted to the swivelling bolsters and secured to the main girders by four steel clutches and 3in. diameter bolts at each end. The bracing frames are so designed that the girders can readily be detached or the width between them be adjusted every 2½in. from 7ft. 6in. to 5ft. 10in. to suit the various types of transformers.

On arrival at the manufacturers' works adjustable legs fitted with rollers are secured to one end of each beam, as supports for the beams, which are then disconnected at that end. The beams with the bogies at the opposite end are then drawn away, leaving space for the reception of the load, which is brought into a position central with the track and supported on packing and jacks. The truck is then reassembled and the transformer lowered until its weight is taken on the trolley beams. On arrival at the site the weight of the transformer is taken on jacks, thus allowing the trolley to be divided as before. The transformer is then fitted with its own wheels, towed to its site, and the trolley reassembled.

TROLLEY WITH BEAMS SUPPORTED ON LEGS

The vehicle will negotiate curves of 1½ chain radius, and is fitted with a G.W. either-side brake on each end bogie and a powerful screw brake on each inside bogie, these being capable of holding the trolley and its maximum load under all normal working conditions. The principal dimensions are as follows :—

Length over buffers	89ft. 6in.
Length over headstocks	86ft. 6in.
Centres of main pivots	55ft.
Centres of supplementary frame pivots	15ft.
Centres of wheels	5ft.
Diameter of wheels	3ft. 2in.
Axle journals	10in. by 6in.
Height, rail to top of girders (fully loaded)	7ft. 9in.
Depth of girder	3ft. 9in.
Load	120 tons
Tare	75 tons 19 cwt.

Beams of the well type, also capable of carrying 120 tons, are under construction to interchange with the straight beams illustrated.

Those members of the Institution of Mechanical Engineers who visited Swindon last week inspected one of these "Crocodiles."

South African Engineering Notes.

Rhodesian Railways.

FIGURES given in a bulletin recently issued by the General Manager of the Rhodesian Railways indicate, for the first time for two or three years, an ebb in the tide of trade. Up till quite recently the monthly returns have shown an interrupted increase, but the April returns disclose a check in the upward tendency of most classes of traffic. It is probable that this check is accounted for, to a large extent, by the fact that the construction work on the copper mines of the North has reached a point where the importation of materials has begun to fall, and a further cause is the continued decline in the output of asbestos from the mines at Shabani and Mashaba, in Southern Rhodesia. Chrome also shows a decline, but it is always a variable factor. A prominent feature of the returns is the upward tendency of the road motor services and their extension. The total earnings of the railways during the financial year ended September last were £5,428,232, the total operating expenditure, excluding reserve for renewal of permanent way and rolling stock, £2,638,754, and the reserve for renewals of the permanent way and rolling stock, £470,430. The gross receipts were £322,000 more than in the previous year and the net operating expenditure £92,000 more. There was an increase in the net ton-mileage for all sections north of Bulawayo of 38,000,000. The total cost of salaries and wages on revenue account during the year was £1,755,000,

as compared with £1,648,000 for the preceding year. There are now 4634 Europeans and 18,122 natives employed on the railways. In the last ten years the total earnings of the railways have increased from £2,500,000 to £5,400,000, the train-mileage from 3,000,000 to 6,200,000, the net ton-mileage from 459,000,000 to 1,100,000,000; the number of the railway staff from 2500 Europeans and 9000 natives to 4600 and 18,000 respectively, and the rolling stock has been almost doubled.

Scrapping Branch Lines.

In addition to the cancelling of two authorised branch lines, on the ground that road motor services had already obtained such a hold that the projected lines had no hope of being payable, the Railway Board has seriously considered the abandonment of certain branch lines in the Union which are losing a great deal of money annually, and as soon as Parliament rises the Board will personally inspect them. One of those most likely to be visited is the Standerton-Vrede line in the Transvaal, which, if it is scrapped, may mean the construction of another railway line from Warden to Vrede. Motor competition is becoming so strong that the branch lines, which were never very remunerative, cannot stand up against it. The Board is also considering, and inquiries are now being made, concerning the introduction of motors to be used on the railway lines. It is considered that if certain branch lines could be supplied with them, it would mean a far better and a much cheaper service than is at present possible with slow engines and long trains. In fact, daily return trips could be made by motor rail where to-day there is a daily train only one way.

A South African Invention.

A type of railway boom which may do much to relieve the level crossing problem in South Africa will shortly be tested by the Railway Administration. The inventor is Mr. R. Jacobson, a mechanical engineer of Durban. The booms are claimed to be the first automatic non-rigid booms in the world. They are worked on the magnetic principle and are said to be fool and weatherproof. They are to be put on trial at the Country Club crossing near the aerodrome at Durban. The booms slide automatically athwart the crossing horizontally at the usual height above the ground. All the work is done by electric power. Economy is one of the main attractions of the invention, as the booms cost comparatively little to construct and the demand on electric current is small. The idea is that a train passing over an electrical contact 300 yards or so from the crossing switches the booms to the closed position, while red lights inform road traffic of the fact. At the same time a green light gives the right of way and informs the driver that the booms are closed. Should a motorist crash into the booms, they give way easily, only to close again automatically. While the booms are thus disturbed the green right of way signal switches off as a notification to the engine-driver to stop, as the booms are not clear.

Rhodesia to Walvis Bay.

The scheme for a railway to connect Rhodesia with Walvis Bay is progressing more rapidly than could have been expected a year ago, owing in great measure to the need that Rhodesia has for a suitable port through which to develop an export cattle industry. The Prime Minister of Southern Rhodesia recently informed the Legislative Assembly that he would be able to announce shortly that the survey of the route had been begun. While it has been decided to survey the line, its immediate construction may not be immediately undertaken. That will depend on the establishment on a sound and wide basis of the cattle industry. If the Southern Rhodesia cattle industry is going to take a prominent part in world supplies, then the Walvis Bay line is essential. There is, however, a further argument in favour of the construction of this line which is now being advanced. If the line was made it would save an appreciable amount of time in the case of passengers and goods for Rhodesia, or for the northern parts of the Union. If the Union-Castle mail boats were to call there after a railway was provided to discharge and embark passengers and goods and provide fast transport for the cattle, there would be another advantage to the people of the Union quite apart from the railway. Walvis Bay might, in fact, become the commercial air route of the future. An air service between Walvis Bay and the Union would shorten the journey of the mail from Europe to Johannesburg by seven days and to Cape Town by five days. At present the Union-Castle Company is demanding an additional subsidy of £70,000 a year to call at Walvis Bay, or, rather, it asked that amount when negotiations on the point took place between the company and the Union Government.

AIRCRAFT APPRENTICES.—The Air Ministry announces that five hundred aircraft apprentices, between the ages of fifteen and seventeen, are required by the Royal Air Force for entry into the Schools of Technical Training at Halton, Bucks., and at Cranwell, near Sleaford, Lincs. They will be enlisted as the result of an open competition and of a limited competition which will be held in the near future by the Civil Service Commissioners and the Air Ministry respectively. Boys in possession of an approved first school certificate may be admitted without other educational examinations. Successful candidates will be required to complete a period of twelve years' regular Air Force service from the age of eighteen, in addition to the training period. At the age of thirty they may return to civil life or may be permitted to re-engage to complete time for pension. The principal trades open to boys are metal rigger, a new trade brought into existence by the introduction of the metal aeroplane, which involves training in both fitting and sheet metal work; fitter (aero-engine); fitter (driver, petrol); fitter (armourer); coppersmith and metal worker; wireless operator-mechanic; and electrician. The apprentices are given a thorough training in their trade by highly qualified technical instructors, and their general education is also carried on simultaneously by a staff of graduate teachers. Full information regarding the dates of the respective examinations, the methods of entry and the aircraft apprentice scheme generally can be obtained upon application to the Royal Air Force (Aircraft Apprentices' Dept.), Gwydyr House, Whitehall, London, S.W. 1.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Summer Quarterly Meeting.

THE midsummer quarterly meeting of the Midland iron trade held in Birmingham to-day—Thursday—was of a far less optimistic character than twelve months ago. The attendance was comparatively small and business in all departments was dull. Whereas at the last summer gathering there was considerable optimism as to the future, industrialists to-day described the outlook as obscure and prospects as poor. Producers of iron and steel are in nothing like the same favourable position as they were a year ago, for while they met then after a brisk, if somewhat brief, buying movement, they gathered to-day after six months of scanty and unsatisfactory business. Order books are "thin" and few firms can look ahead with confidence. Moreover, to-day's meeting added very little business, consumers of iron and steel being unprepared to order material in advance of their requirements. In the case of raw iron they consider the price they are asked to pay to be in excess of the market value, and partly as a protest they refuse to buy until necessity compels. They even talk of introducing foreign iron into the district, a thing practically unheard of since the coal mines stoppage in 1926. Midland industries are not well employed and the calls made upon producers of iron and steel are below their capacity to produce. The forges and foundries are short of work, structural engineering yards are slack, general and automobile engineers are but moderately engaged, and heavy edge tool makers, chain and anchor manufacturers and the nut and bolt trades are all dull. Rolling stock establishments are more favourably placed, as are boilermakers and electrical engineers. On the whole, little improvement in business is expected to result from to-day's meeting and interest in it, therefore, was not as great as is usually the case.

Native or Foreign Pig Iron.

There is no improvement in the pig iron situation on the week. Demand is irregular and for small tonnages, and stocks at the Midland furnaces are reported to be steadily increasing. At to-day's quarterly meeting there was considerable talk of importing foreign pig iron for ordinary foundry uses in the district as a protest against the present level of prices fixed by the Pig Iron Producers' Association, and considered by users to be unfair. It is stated that offers of supplies of continental pig have been received in Birmingham this week which, after meeting charges of delivery to this area, compare favourably with the prices now asked for Derbyshire material. Consumers of pig iron are doing their best to break the grip now held by smelters, and it is claimed that they will buy this foreign iron, provided it costs them no more than they are at present paying. "As a means to an end" foreign pig iron of this character has not been imported into this district in any quantity since the cutting off of home supplies as the result of the coal dispute in 1926. Freight and transport costs to an inland district like Birmingham have put the foreigner out of the market, and whether he will be able now to put forward a proposition acceptable to Midland users of pig iron remains to be seen. One thing is pretty certain, and that is that consumers are so incensed with what they term the unjust and high-handed action of the blast-furnacemen that they will not consider the smelters' point of view any more than they assert the smelters have considered theirs. If they decide that the purchase of foreign iron will bring down local makers' prices, then they will buy it, if it costs them no more, irrespective of the quality. The position is being closely watched by all concerned. Indeed, it provided the chief centre of interest at to-day's gathering. Apparently, the matter still hangs fire, for no information of definite business having been done with continental agents was to be had. Derbyshire and Northamptonshire furnacemen maintain their selling figure for No. 3 foundry iron at £3 18s. 6d. and £3 15s. respectively. Little business was done.

Finished Iron.

Ironmasters in South Staffordshire are experiencing an unusually difficult time and though, on the whole, they remain cheerful, it is difficult to see how they are to carry on until the trade revival sets in. During the past twelve months business has gone from bad to worse, especially in the merchant and common bar departments, and, furthermore, there are no visible signs of an early improvement. Selling prices are claimed to be at rock bottom and little, if any, addition to demand would follow a lowering of values. Crown bars are subject to severe competition from makers in other districts, who sell a somewhat inferior grade bar at a cheaper rate. It is suitable for local maker's requirements and so is purchased. In the common bar department the foreigner secures the greater portion of the business, his selling figure for material utilised for the nut and bolt trade for similar purposes to Staffordshire common bars, being more than £3 per ton cheaper. This competition becomes keener and keener, and this week supplies of Belgian No. 3 iron were on offer at as low as £5 10s. delivered in this district in contrast with local makers' prices of £9. Ironmasters have also to face the competition of steel, and their position is an unenviable one. Fortunately, the marked bar mills find a steady demand, this class of iron being in regular use for special engineering purposes. Makers are able to maintain regular work at the mills and to get the full price of £12 10s. per ton for their output. This figure is 10s. per ton in advance of that ruling at this time last year. Crown bars command about the same price as a year ago, and common bars are some 5s. per ton cheaper than they were then. Sellers of iron strip say that demand keeps up well and they have no difficulty in getting £11 2s. 6d. per ton for all they have for sale. This is the other fortunate department of the Staffordshire iron trade at date, and here again values are in advance of those ruling a year ago, but only to the extent of half-a-crown per ton.

Steel.

There is a scarcity of bulk business in the steel department and buying to-day was again on the small side. Mills in this district are unable to make full time, even with the limited plant now in operation. The slackness is apparent in all departments and tends if anything to become worse. While values of finished steel have advanced since the last summer quarterly meeting, selling prices of half-products have declined. It must be remembered, however, that the rates quoted for finished material are subject to substantial reductions in the case of consumers refraining from purchasing continental supplies. Though the amount of foreign steel that is being bought just now is not very large, it is of sufficient volume seriously to affect the home position. Given this additional business native steelmasters would be in a very different position to what they are at date. Specifications are not up to expectations and the outlook for the current quarter is not encouraging. Steel angles were firmly quoted to-day at the Association fixed price of £8 7s. 6d., joists £8 10s., ship, bridge and tank plates £8 17s. 6d. Boiler plates command £9 12s. 6d. and Staffordshire hoops £10. Re-rollers are only moderately employed and have no easy task to keep the minimum selling figure at £8 per ton. Similar material from the Continent is procurable at £6 10s. Small bars rolled from native raw material command up to £8 15s. per ton. Mild steel billets make £6 per ton, offers to take supplies at a reduced rate being turned down by Midland producers. The steel works are not making new contracts for scrap, owing to the slowing down at the works, and merchants experience difficulty in making sales. Values are weak and indeterminate.

Galvanised Sheets.

Makers of galvanised sheets have added further to their order books and a few fortunate firms have a couple of months' work in hand. The important markets in the East are still too disorganised to provide their customary quota of business, but export orders generally this past week have shown a decided improvement, while home consumers have kept up their calls. Values continue at £11 17s. 6d. per ton for 24-gauge corrugated sheets, but some mills have been endeavouring to obtain 7s. 6d. per ton more for small scale home transactions. Whether they have met with any success it is difficult to determine. It is noteworthy to note that at last midsummer meeting 24 gauge sheets were quoted £13 10s. to £13 15s. per ton, and business was quiet. Local mills were, however, then better placed than they are at date.

Bicentenary Celebration.

W. and T. Avery, Ltd., Soho Foundry, Birmingham, have, since my last letter, celebrated the bicentenary of the Soho Works, and on the occasion visitors from all parts of the Kingdom and the Dominions had an opportunity of inspecting the works, which in their time have been associated with Matthew Boulton, James Watt and William Murdock. They were particularly interested in the historic relics of the foundry. They saw the entrance gate built by Boulton, the gasometer—the first container in the world—erected by Murdock, and the old drilling machine designed for the machining of the cylinders of Watt's early steam engines. At the luncheon which followed the tour of the works interesting references were made by the speakers to the early history of weighing machines and to the extent of their development.

Industry and Severn Navigation.

The River Severn Development Association, which was formed some twelve months ago and has as one of its objects the development, from an industrial point of view, of the river Severn, has taken steps to urge upon the Gloucester City Council and the Ministry of Transport the necessity for considering the interests of navigation when the proposed alterations are made to the Westgate Bridge, Gloucester. It is feared that the successful navigation of the waterway may be overlooked, undue prominence being given to road development. The country's interests, it is pointed out, lie equally in the waterways and the roads. Vessels of 200 tons burden have been hampered and delayed on many occasions owing to the low clearance between the water level and the underside of the Westgate Bridge.

Expansion of B.I.F.

Plans have been prepared for the addition of 65,000 square feet of letting space, if necessary, to the next British Industries Fair at Castle Bromwich, Birmingham. This year almost a thousand firms occupied 220,000 square feet of space, and it is anticipated that this will be insufficient to meet the needs of next year's Fair. Year after year there has been a marked growth in the number of exhibitors, and the space occupied and the prospects for 1931 are considered to be very good.

£29,000 Sewerage Scheme.

The Seisdon Rural Council has approved a sewerage scheme for Codsall and Oaken at a cost of £29,683. The work is to be proceeded with as soon as possible on the understanding that the Unemployment Grants Committee will provide financial assistance. The Staffordshire County Council is to be approached for a contribution towards the expense.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

New Types of Plant.

DEVELOPMENTS in textile and other classes of machinery received prominent mention by Mr. J. S. Nuttall, chairman of Platt Brothers and Co., Ltd., Oldham, at the annual meeting. Patent rights have been acquired in respect of two new types of automatic loom, and a large home and foreign demand for these machines is anticipated

in the future. Other plant recently marketed includes a new ring frame, blowing machinery, a carpet loom, a card, and a cage well. An interesting development referred to by Mr. Nuttall is that the company is endeavouring to revive the brick-making side of its business. It is at present constructing two machines of a new type, and arrangements have been made for them to undergo practical trials by brickmakers.

Trouble in Overseas Markets.

Mr. Nuttall is not too hopeful regarding the immediate future of the textile machinery industry. The home demand for plant depends largely upon the state of the cotton spinning trade. At present there is no sign of improvement in this branch, although if and when it arrives it is expected that a considerable amount of machinery will require renewing. On the foreign side, there is some hope of a bigger business being done with Russia, but in a number of other overseas markets, particularly in the East, serious troubles are being encountered. In India, for example, the Gandhi trouble has resulted in a boycott of British goods, which has had a serious adverse effect on machinery exports to that country, which, for years, has been the most important individual market for British textile machinery. Difficulties in the Japanese market have arisen from the abolition of night work. That country now finds herself faced with more severe competition, and in consequence delivery of several orders for new machinery placed in this country has been suspended.

A Business Appointment.

Following upon his election to the board of directors, Sir Walter R. Preston, who is also a director of J. Stone and Co., Ltd., engineers, Deptford, has been appointed chairman of Platt Brothers and Co., Ltd.

Purchase of Goodwill.

Browett, Lindley and Co., Ltd., engineers, of Sandon Works, Patricroft, near Manchester, announce that they have purchased the whole of the patterns, drawings, goodwill and trade name of Bumsted and Chandler, Ltd., high-speed engine, pump, and fan manufacturers, of Cannock Chase Engine Works, Hednesford, Staffordshire.

More Refuse Disposal Plant.

Manchester Corporation Cleansing Department has recommended the acceptance of the tender of Messrs. Petrie and McNaught, Rochdale, for the supply of refuse disposal plant, at a cost of £12,000, for installation at the Mount-road depôt. The Cleansing Committee estimate that similar plant put down recently at the Water-street depôt has resulted in a saving on refuse disposal costs of between 2s. 3d. and 2s. 6d. a ton.

Non-ferrous Metals.

The non-ferrous metal markets have not yet attained a position of stability, and copper, in particular, has belied the promise held out by the slight recovery in the two previous weeks, for a fresh reaction has set in since my last report. The consuming industries in this branch are buying in limited quantities only, and there is a marked absence of speculative support for the market. With the widespread knowledge of the existence of heavy stocks of the metal, the "bearish" influence on prices cannot be resisted. The tin section of the market is similarly circumstanced, and here also buyers are holding off as much as possible. Current values are not quite back to the low point touched at the middle of last month, but with the fresh decline registered during the past week they are not very much above it. Relatively, the position of lead seems to be the strongest. A fair amount of buying interest in the metal is being displayed, and there is not the same cumbersome margin between supply and demand as there is in the case of the other sections. On balance, prices have been maintained at the level that has been ruling for several weeks. The fall in spelter goes on week by week, and sales are very moderate.

Iron and Steel.

There has been no improvement in the general condition of the iron and steel markets here. The majority of the foundries in the Lancashire area are engaged at below capacity and the worsening of the position compared with six or eight months ago is amply reflected in the contraction in deliveries. Buying at the moment, as it has been for some time now, is virtually on a hand-to-mouth scale, and there are few consuming firms which are justified in departing from this policy. Staffordshire and Derbyshire foundry iron is quoted at 77s. per ton for delivery into the Manchester price zone, forge iron at 72s., Scottish at about 93s., and West Coast hematite at 89s. Bar iron is steady at £10 5s. per ton for Lancashire Crown quality, and about £8 15s. for seconds, but the demand in this section is quiet. In the case of the steel market there is a moderate demand about in respect of boiler plates and other varieties for locomotive engineers, while specifications are also of fair extent for delivery to certain speciality firms. Constructional engineers, however, as well as boilermakers, textile machinists, and general engineers, are content to buy in small parcels for near delivery. Quotations for boiler plates are now in the neighbourhood of £9 15s. per ton, with small bars offered by re-rollers at anything from £7 15s. to £8. In other respects the market is maintained at £8 10s. per ton for joists, £8 7s. 6d. for sections, £9 7s. 6d. for large bars, and £8 17s. 6d. per ton for general plates. Business in imported iron and steel materials is largely of a retail character, and in spite of the Cartel's price-fixing scheme, cheap offers on this market are still very much in evidence.

BARROW-IN-FURNESS.

Hematite.

Already there are unmistakable signs of a falling off in business. As was hinted at in previous letters, the number of furnaces in blast has been too many for the demand, and the first company to undertake restriction, the North Lonsdale Iron and Steel Co., Ltd., at Ulverston, blew out a furnace on Monday. There is every reason to expect that others will go out in the future, for apart from the quiet state of the pig iron trade, the likelihood of even a fair demand locally on steel account is very remote. The falling off in business seems to be principally due to less activity among engineers and shipbuilders. The iron ore trade is naturally affected. The local demand is easier with a thinner outlook, and the amount of business in native ores outside the district is dwindling. Foreign ores are similarly affected. The steel market is dull and orders are few and hard to secure. Both the Barrow and Workington mills are going at present, but orders are being completed more rapidly than fresh contracts are being secured. Shipping is quiet. Shipbuilding is moderate, and engineering fair.

SHEFFIELD.

(From our own Correspondent.)

Steel Trade Depression.

DULL trade conditions continue to prevail in the steel and allied industries of the Sheffield district, and it is difficult to discover any definite signs of improvement. Complaints of poor business are being made with monotonous regularity by some firms, and consequently there seem to be grounds for the contentions of some critics who suggest that the constantly recurring talk of "depression" and "hard times" is not doing Sheffield industry any good. It is suggested, with reason, that orders may not be given to a city where it is said "depression is at its worst." There are optimists, however, who believe that when the second half of the year gets well into its stride, and when such disturbing influences as the close of financial periods and stocktaking are out of the way, there may be a revival in trade. Nevertheless, there is no getting away from the fact that existing conditions are very bad, and a typical example of this is provided by the fact that the United Steel Companies have only one furnace working at The Ickles on acid steel, whilst at their large Templeborough plant they have seven furnaces working on basic steel out of a total of fourteen.

Efforts to Improve Position.

It has been stated before, but is sometimes forgotten, that the tonnage of Sheffield steel and steel products at the present time is greater by half than during the busiest of pre-war years. Unfortunately, this production is not sufficient to employ the greatly improved and extended plants to anything like their full capacity. It is estimated, in fact, that the iron and steel industry is only working to two-thirds of its capacity, and manufacturers and works managers are continually endeavouring to discover business to increase their output. Economy campaigns in management costs have been carried out ruthlessly, and prices have been severely pruned, but in many instances even these drastic measures have not been effective in meeting certain foreign competition. Fortunately, quality often turns the scale in Sheffield's favour, whenever prices are at all comparable.

Sheffield and South America.

As previously mentioned, Sheffield is sending an important industrial mission to South America with a view to increasing the city's business in that part of the world. This mission, which is unique in character, will take place under the auspices of the Government and with the full support and assistance of his Majesty's representatives in all the South American countries visited, including Brazil, Uruguay, Argentine, Chile, and Peru. It will sail for Rio de Janeiro on August 1st, and will be headed by the Master Cutler, Mr. A. K. Wilson. The further announcement is now made that Mr. Wilson will be accompanied by Mr. C. R. Hodgson, the President of the Junior Chamber of Commerce in Sheffield, who is sales manager to the firm of James Neill and Co. (Sheffield), Ltd., of the Composite Steel Works, Napier-street. Mr. Hodgson, who entered the steel industry on leaving school, is only twenty-six years of age, but he has travelled in France, Belgium, and Holland, and is well fitted to act as one of the apostles of Sheffield trade.

Movements in Special Lines.

A considerable trade is still being done in meeting the requirements of motor car manufacturers in the way of steel and steel parts, but there has been some falling off in orders recently. It is suggested that although there is no fear of any immediate removal of the McKenna Duties, there is no guarantee of the future position, and consequently a policy of buying on the hand-to-mouth principle, merely to meet immediate requirements, has been adopted by many firms. So far as stainless, non-corrodible, heat-resisting steels, and cold-wrought steel are concerned, substantial business is being done, but not to the same extent as at this time last year. There has been some slight improvement in the call for railway material, but this has been long overdue. The Bombay, Baroda and Central India Railway, it should be noted, is inquiring for boilers for locomotives, signalling cables and wheels and axles for wagons. The same company has issued an inquiry for steel material—angles, channels, flats, plates, &c.

Steel Foundry Developments.

In order to meet a demand for small steel castings, which are accurate, sound and sharp at the corners, members of the technical staff at Edgar Allen's steel foundry, Sheffield, have invented and put into use a new method of making these castings. This method is said to be exceptionally efficient in production and advantageous from the point of view of the user. Castings varying in weight from a few pounds to over a hundredweight are being made with unusual accuracy. The process is particularly adopted to repetition work, and specially constructed moulding tackle is required. Perfectly sound and clean castings with a thickness as small as $\frac{1}{8}$in. over a considerable area, can be made in some cases, and the accuracy is such that in many cases only $\frac{1}{64}$in. a side will be required for machining purposes. By the process, ordinary, manganese, and other alloy steel castings can be made, and it is specially suitable for trackless road links, conveyor and elevator links, rollers, manganese steel aeroplane skid shoes of various designs, commutator rings, small magnets, brake drums, levers, brake shoes, valves, brackets, hubs and covers.

New Heavy-Oil Engine.

Following the news of a new combine arrangement between Ruston and Hornsby, of Lincoln, and Lister and Co., of Dursley, the well-known engineering, agricultural machinery and oil engine firms, comes the announcement that Rustons are placing on the market an entirely new horizontal heavy-oil cold-starting engine. This engine has now been tested and extensive claims are being made for it. The sizes to be put on the market are 17 to 66 B.H.P.

The Lighter Trades.

Business continues poor in the cutlery, plate, tools, &c., trades of the Sheffield district. The prospect of the removal of the 33⅓ per cent. safeguarding duties in December has led buyers to reduce their orders so as merely to cover their immediate requirements, and they are waiting to take advantage of market conditions when these duties have been removed and the expected flooding of this country with cheap German cutlery, &c., has taken place. Conditions in the precision tools and small tools departments are moderately good, but the demand for files continues poor.

Chesterfield Sewerage Schemes.

Chesterfield Rural District Council has approved schemes, prepared by its engineer and surveyor, Mr. H. Taylor, for works of sewerage and sewage disposal at North Wingfield and Pilsley, at a cost of £10,776, and at New Tupton at a cost of £6480. The Unemployment Grants Committee is to be asked for a grant towards the cost of the work.

NORTH OF ENGLAND.

(From our own Correspondent.)

Another Works to Close Down.

THE Ayresome Ironworks, of Gjers, Mills and Co., Ltd., Middlesbrough, are to be damped down this week-end for an indefinite period. It is another act in a lamentable story of industrial decline. Less than a year ago there were forty-six blast-furnaces operating on the North-East Coast; on January 1st last the number had dwindled to forty-one; and to-day it is down to twenty-nine. During a period of six months the following six North-Country ironworks have closed down completely:—The Carlton Ironworks, Stillington; Jarrow Ironworks, Jarrow; Linthorpe Ironworks, Middlesbrough; Dinsdale Ironworks, Dinsdale; Newport Ironworks, Middlesbrough Ayresome Ironworks, Middlesbrough. In every case the precipitating cause has been the same—bad trade and unprofitable prices. Gjers, Mills and Co. have done their best to keep plant and workmen employed, but they have been unable to find a market for the whole of their output, and having large accumulated stores on hand they have been compelled to cease production until these stocks are disposed of and there is a reasonable prospect of a market for their output. Meanwhile, a few hundred men will be thrown out of employment.

Imports of Iron and Steel.

Imports of iron and steel from foreign sources are gradually dwindling. Statistics presented at this week's meeting of the Tees Conservancy Commission showed that during June 10,260 tons were imported, as against 16,677 tons in the corresponding month last year, and 5226 tons in June, 1914. The total imports for the past eight months show an appreciable decline in comparison with the iron and steel imports during a similar period in 1928–29, the figures then being 47,944 tons. Crude sheet bars, billets, blooms, slabs, &c., imported during the eight months reached 69,821 tons, as compared with 66,008 tons in the corresponding period of 1928–29 and 30,307 tons in 1913–14. Pig iron imports during the same period amounted to only 6393 tons, as against 19,381 tons and 218 tons; while the imports of plates, bars, rails, angles, joists, &c., totalled 23,229 tons, as compared with 34,227 tons and 17,419 tons respectively.

Cleveland Iron Trade.

Business in the Cleveland pig iron trade still develops on very slow lines, and consumers are refusing to take full deliveries as they fall due under running contracts. The approach of the Glasgow Fair holidays, which, it is understood, this year will extend over a longer period than usual, has had the effect of stopping deliveries to Scotland. Generally there is a more hopeful view of the situation, but it must be confessed that consumers are still acting with caution, and decline to commit themselves far ahead. The death of the Coal Mines Bill has removed the fear of dearer fuel, but makers in this district are resolved not to cut prices, and point out that the blast-furnacemen's wages cut will have no effect on costs of production. Prices are still steady, No. 1 Cleveland foundry being 70s., No. 3 G.M.B. 67s. 6d., No. 4 foundry 66s. 6d., and No. 4 forge 66s.

Hematite Pig Iron.

East Coast hematite pig iron is abundant. Continental competition in overseas markets is severe, and merchants are still undercutting producers of East Coast brands, both for home and export trade. The attitude of makers is, however, slightly firmer than of late, as output is likely to be brought more into line with moderate market needs. Ordinary mixed numbers are no more than 71s., and No. 1 quality is at a premium of 6d. per ton.

Ironmaking Materials.

There is no sale in this district for foreign ore, and prices are quite nominal, best Rubio ore being 20s. per ton c.i.f. Tees. Durham blast-furnace coke is plentiful, and remunerative prices are unobtainable. Prompt parcels of good average qualties can be bought at about 16s. 6d. delivered to North-East Coast works, but makers threaten to cease producing rather than sell forward on such terms.

Manufactured Iron and Steel.

The position at most of the steel works in this district is irregular. The loss of a substantial portion of the Indian and Australian trade is severely felt; but, on the other hand, there is a sustained demand for constructional steel, and recent orders placed, encourage the hope that there will be a better autumn demand for shipbuilding material. There is slightly more inquiry for sheets. Prices are unchanged.

Shipbuilding Orders.

The firm of Swan, Hunter and Wigham Richardson, Ltd., of Southwick, Sunderland, has secured a contract for a vessel of about 3400 tons deadweight, for Portuguese owners. The machinery will be supplied by the company's Neptune Engine Works, at Walker-on-Tyne. The firm has also received confirmation of an order from the Egyptian Government for a fisheries research vessel. The order is not a big one, and the work, it is understood, will be completed within about three or four months. The vessel is to be 140ft. in length, and will be built at the company's Wallsend yard.

Blast-furnacemen's Wages Reduced.

As a result of the quarterly ascertainment issued by the Cleveland Ironmasters' Association this week, the wages of blast-furnacemen employed at ironworks on the North-East Coast have been reduced by 3 per cent. for the current quarter. The average net selling price of No. 3 Cleveland pig iron, which governs the men's wages under a sliding scale, is certified at 65s. 9·99d. per ton for the past quarter, a drop of 3s. 1·69d. per ton, as compared with the realised price for the first quarter of the year. This is the first reduction in wages the men have suffered since June, 1928. Their wages are now 11¾ per cent. above the standard.

The Coal Trade.

The general position in the Northern coal trade shows no signs of improvement. Only a few collieries are succeeding in avoiding lost time, and the orders in prospect do not promise any more regularity in working. Everything points to a continuance of the present slack demand. The reduced production has had no effect on the market, as supplies, even with the output so much curtailed, are more than sufficient for general needs. Foreign and coastwise shipments from the North-East Coast are heavily down on what they were for the first six months of last year. In no direction are customers taking so much coal as they did—which goes to show the international character of the trade depression. In Northumberland the outlook is no better, and there is reason to believe that the country's formidable rival, Poland, will be more powerful still in the future, owing to the great developments which are going on at the Polish port in Gdynia. Hitherto, most of the Silesian coal has been shipped through the free port of Dantzig, but that is not likely to be the case in the days to come. Poor as the trade is in Northumberland at present there is no disposition to interfere with the current minimum prices. Best Northumberland steams are at 13s. 3d. to 13s. 6d. Small steam coal is abundant and stocks are steadily increasing. Best qualities are at 10s., ordinary at 9s. 6d., and special brands at 10s. 6d. In Durham county both gas and steam coals are experiencing a quiet time, and 13s. is about the most that producers of coking coal can command at the moment. Gas coals are weak and nominal at 12s. 9d. to 13s. Bunkers are cheap at 12s. 9d. to 14s., according to class. Early this year the best brands were able to get 17s. The output of gas coke is very moderate and supplies available for export rather scarce. Prices are holding firmly at 21s. 6d. Patent oven coke is in slow demand for prompt shipment, stocks being large and offered at 17s. for good brands. The forward tone is steady, but definite business matures slowly. Nominal prices are 18s. Beehive and superior grade foundry coke is steady at 24s. to 28s.

SCOTLAND.

(From our own Correspondent.)

Markets Unchanged.

THE general position has shown little alteration during the past week, and with the holiday season almost here there is not likely to be any change for a few weeks at least. In view of recent shipbuilding orders the outlook for certain districts has improved somewhat, but it may be well into the autumn season before the improvement is noticeable.

Probable Steel Merger.

Almost the only item of interest in the steel trade meantime is the proposed merging of the interests of James Dunlop and Co., Ltd., and David Colville and Sons, Ltd. The former company owns the Clyde Iron Works, the Calderbank Steel Works, and the Clyde Collieries, while the latter firm, which is allied with Harland and Wolff, Ltd., owns the Dalzell Steel Works at Motherwell, Clydebridge Steel Works, Cumbuslang, and the Glengarnock Iron and Steel Works, Glengarnock. Early this year Messrs. Colville acquired the goodwill of Beardmore and Co.'s steel business in so far as plate, sections and rails are concerned. The Colville works have an estimated capacity of 1,000,000 tons of steel ingots per annum, equal to fully 10 per cent. of the total British capacity. The Motherwell works were started in the year 1871.

Steel.

Generally speaking, steel makers are not able to run their works more than three days per week at present. Shipbuilding materials are sparsely specified and some time must elapse before any improvement in this respect can be expected. Business in tubes is somewhat uneven. Large tubes are comparatively well specified, but other descriptions are greatly in need of orders, some of the producing works being almost at a standstill. Sheets also are experiencing a most uneven demand. Light gauges are comparatively well specified, but heavy sheets are neglected. The plants producing galvanised sheets are only working at half capacity.

Iron.

Bar iron and re-rolled steel bars are poorly supported and idle time is prevalent at the works. Pig iron makers have not reaped any benefit from the reduction in prices, and in all probability the number of furnaces in action will show a reduction after the holidays.

Scrap.

The market for scrap has weakened further and heavy steel is now quoted about 52s. 6d., heavy basic 55s., and cast iron machinery 65s. per ton.

Coal.

Continued weakness characterises the coal market. The general demand—despite a drastic curtailment of output—is not sufficient to account for the production, and in most cases prices are a matter of arrangement so far as round coals are concerned. Nuts maintain a semblance of firmness owing to reduced supplies. Aggregate shipments amounted to 244,986 tons, against 246,878 tons in the preceding week, and 306,945 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

The Coal Trade.

COAL trade conditions in this district have not materially altered during the past week. There is a little more business about, but the quantity is not sufficient to have any perceptible effect upon the market and certainly the majority of collieries find it difficult to work with any regularity. Shipments continue to run about 500,000 tons to just over 550,000 tons per week, but this total is quite inadequate to make collieries busy. The Customs returns for June do not make good reading, as, according to these, cargo exports to foreign markets came to only 1,720,196 tons, which compared with 2,057,535 tons for May and with 2,126,723 tons for the corresponding period of last year. At the moment there are no really outstanding inquiries on the market, and as the conditions prevailing in the German coal trade are very unsatisfactory there can be no doubt that especially severe competition can be expected from this quarter. Evidence of this has already been experienced during the past few months. That competition will be intensified is without question, seeing that the production costs have been reduced, wages having been cut down by 7½ per cent., while, as from the beginning of this month the freight tariffs on coal sent to Belgian, Dutch and German ports for shipment overseas have been reduced. The fact that trade generally is below the average is shown by the daily list of idle appliances at the docks in this district. At the end of last week the number was 47, but arrivals of tonnage over the week-end brought this figure down to 36, while the position further improved on Tuesday, as the number was 25 and there were five steamers waiting to load. It is not a case of tonnage not being available. As a matter of fact, tonnage is offering fairly freely, much more so than might be expected considering the unremunerative state of the freight market. The plight of the shipowners is as bad as that of the coalowners, as, instead of outward rates improving, they have become even more irregular. The market for tonnage for the Mediterranean is deplorable, as the rate for big tonnage is back to 6s. for West Italy. The surprise is that there is so much tonnage in commission, as homeward business is by no means too good.

Iron, Steel and Tin-plates.

A re-start was made last week at No. 2 works of the Old Castle Tinplate Company, Llanelly, which have been closed down for six weeks as a result of damage done during a boiler explosion. At present four of the six mills are resuming, and it is expected that the other two will be operated at an early date. On the other hand, the report is to hand that both the Cambria and the Glamorgan tin-plate works at Pontardulais have been closed down for an indefinite period. The bad time which the Ebbw Vale Steel, Iron and Coal Company, Ltd., has experienced is reflected in the report and accounts of this undertaking for the year ended March last. The total net loss was £344,717, which compared with a loss of £407,394 in the previous year. During the past week or so members of the Permanent Way Institution have been holding their annual gathering in this district. At the annual dinner at Cardiff on Saturday last, Mr. W. Simons, J.P., director of Guest, Keen and Nettlefolds, Ltd., gave some very interesting information regarding the iron and steel industry. He pointed out that works in South Wales which the Institution intended visiting were closed down. There were, he said, only four blast-furnaces at work in the whole of South Wales, and he very much feared that within the next two or three weeks there would only be two at work. Meantime, 10,000 tons of pig iron were coming into the Bristol Channel ports per month. The purchasers only benefited from that importation to the extent of 2s. per ton. The dumper only cut prices to a point just below the cost price of manufacture in Britain. The benefit of the 120,000 tons of pig iron imported into Bristol Channel ports in a year was about £12,000. Yet, if the pig iron had been manufactured in South Wales, between the coal to be raised to make it and the converting of the coal into coke and transport of goods between the different works, no less than £280,000 would be paid. And out of the £280,000 no less than £54,000 would be paid for transport. The same thing applied to steel. There was over 25,000 tons of steel imported into Bristol Channel ports every month. That was enough to keep two or three large mills working. The figures, if analysed with the cost of steel, would be greater even than those he had given for pig iron.

North Wales Coal Audit.

For the three months ended May the audit for the North Wales coalfield shows a credit balance of £12,441, or 3·38d. per ton, on an output of 883,340 tons. The trading position, however, has deteriorated and the results in May showed a loss of ¼d. per ton compared with a profit in April of 2·40d. and in March of 7·77d. per ton. The auditors have certified the wage as 5·33 per cent. above the basis rates, but the minimum wage for the district is 22 per cent. above the basis rates and in paying this minimum there was a deficiency of £62,963, which increases the deficiency carried forward to £3,216,759.

Ship Repairing.

Naturally, as the conditions in the coal export trade are so unsatisfactory in this district, an adverse effect is caused to the ship-repairing industry. All the leading combines have been working below their capacity for some time past, and there has been a marked absence of real heavy orders. Still, there has been a fair amount of general repair work carried out, though it is refreshing to find a substantial order coming the way of local works. Such a case is that of the Cardiff-owned steamer "Portgwarra," which suffered considerable damage through stranding on Castle Island in the Bahamas Straits, north of Cuba. The repair work will take about seven weeks and is being carried out by the Penarth Pontoon Slipway and Ship Repairing Company, Ltd. The s.s. "Portgwarra" is a steamer of 8000 tons deadweight carrying capacity.

Steel Works to Close Down.

Owing to the lack of orders, the blast-furnaces and steel department at the Dowlais Works, Dowlais, will close down at the end of this week. The result will be that about 1500 men will be thrown out of employment. It is understood that the British (Guest-Keen-Baldwins) Iron and Steel Company, Ltd., will reopen the works as soon as orders can be secured. The stoppage at the Dowlais Works adversely affects operations at the Llanharry mines of the Glamorgan Hematite Iron Ore Company, Ltd. These mines closed down on Wednesday of this week for an indefinite period, so that about 500 men in the Pontyclun area are thrown out of employment.

Current Business.

There is no outstanding feature in the steam coal trade. New orders are slow to come along on the whole, and the position of collieries is very uneven. Some are not at all badly off for prompt positions, but the majority are in need of new business. Sized coals continue to show a good tone, but large qualities of all descriptions are plentiful. Smalls can also be obtained without much, if any, difficulty. Coke is very quiet in demand, but the position of patent fuel makers is rather better. Pitwood is not so firm, as the labour troubles at Bordeaux have come to an end, which means that supplies are coming along more freely. The price went up to 29s. to 30s., but has since then come back to about 27s. 6d.

CATALOGUES.

BRITISH PORTLAND CEMENT ASSOCIATION, Ltd., 20, Dartmouth-street, S.W. 1.—A small brochure on "Cement-bound Roads."

PORN AND DUNWOODY, Ltd., 72–78, Fleet-street, E.C. 4.—A sixty-four-page book of marine engines built by Motorenfabrik Deutz A.-G.

G. WALLER AND SON, Ltd., Phœnix Ironworks, Stroud, Glos.—A catalogue of machinery for gas pressure raising and high-pressure gas transmission.

JAMES ARCHDALE AND CO., Ltd., Birmingham.—Second edition of the firm's catalogue of drilling machines, milling machines and equipment for the automotive industries.

GENT AND CO., Ltd., Leicester.—Catalogue sections dealing with telephones for offices, institutes and industrial buildings; and "Pul-syn-etic" system of electric impulse clocks and time discipline apparatus.

CONSOLIDATED PNEUMATIC TOOL COMPANY, Ltd., 170, Piccadilly, W. 1.—The following new publications:—S.P. 144, garage equipment; S.P. 145, No. 88 rotary grinders; S.P. 146, rock drills, &c.; S.P. 147, No. 3 double grinder; S.P. 148, rotary electric scaling tools; S.P. 149, CP-116 pile driver; S.P. 150, Fraserburgh hammer repair vice; S.P. 151, Diesel engine driven portable plants.

ASYUT BARRAGE.—With reference to the previous notice concerning the intention of the Egyptian Government to invite tenders for the remodelling of the Asyut Barrage in Upper Egypt, it is brought to the notice of the public that the Egyptian Government has decided to postpone the above-mentioned adjudication.

GOVERNMENT AND PRICES.—The Federation of British Industries has appointed a committe which will furnish to the Government views upon the general principles of price maintenance. Its members are Sir Roland Nugent, director of the Federation; Mr. S. E. Cash, its solicitor, and Mr. H. L. Kenward, sales manager of the Dunlop Rubber Company, Ltd. Mr. Kenward has prepared evidence, more particularly applicable to the tire industry, which has been forwarded through the India Rubber Manufacturers' Association to the Board of Trade.

EDUCATION FOR QUARRY ENGINEERS.—It was announced at the annual conference of the Institute of Quarrying at Scarborough, July 2nd to 5th, that arrangements were being made for instruction in quarrying at the Imperial College of Technology, London University. We may add that the course will be the ordinary three years' course for civil engineering students, followed by a special post-graduate course in quarrying, but arrangements will be effected by the Institute of Quarrying to enable students to gain specialised experience during the long vacations.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
(1) Native	18/6 to 20/-
(1) Spanish	20/6 to 21/-
N.E. COAST—	
Native	18/- to 21/-
Foreign (c.i.f.)	20/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	3 19 6	—
No. 1 Foundry	3 19 0	—
No. 3 Foundry	3 16 6	—
N.E. COAST—		
Hematite Mixed Nos.	3 11 0	3 11 0
No. 1	3 11 6	3 11 6
Cleveland—		
No. 1	3 10 0	3 10 0
Siliceous Iron	3 10 0	3 10 0
No. 3 G.M.B.	3 7 6	3 7 6
No. 4 Foundry	3 6 6	3 6 6
No. 4 Forge	3 6 0	3 6 0
Mottled	3 5 6	3 5 6
White	3 5 6	3 5 6
MIDLANDS—		
(3) Staffs.—	(*Delivered to Station.*)	
All-mine (Cold Blast)	—	—
North Staffs. Forge	3 15 6	—
" " Foundry	3 19 6	—
(3) Northampton—		
Foundry No. 3	3 15 0	—
Forge	3 11 0	—
(1) Derbyshire—		
No. 3 Foundry	3 18 6	—
Forge	3 14 6	—
(3) Lincolnshire—		
No. 3 Foundry	3 13 6	—
No. 4 Forge	3 9 6	—
Basic	—	—
(4) N.W. COAST—		
N. Lancs and Cum.—		
Hematite Mixed Nos.	4 5 6 (*a*)	—
	4 8 6 (*b*)	—
	4 12 6 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 10 0	—
Common Bars	10 15 0	—
Best Bars	11 5 0	—
Double Best Bars	11 15 0	—
Treble Best Bars	12 5 0	—
LANCS.—		
Crown Bars	10 5 0	—
Second Quality Bars	8 15 0	—
Hoops	13 0 0	—
S. YORKS.—		
Crown Bars	11 0 0	—
Best Bars	11 10 0	—
Hoops	12 0 0	—
MIDLANDS—		
Crown Bars	10 0 0 to 10 7 6	—
Marked Bars (Staffs.)	12 10 0	—
Nut and Bolt Bars	9 0 0 to 9 7 6	—
Gas Tube Strip	11 2 6	—

STEEL. (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates (Marine)	10 10 0	10 10 0
" " (Land)	10 0 0	10 0 0
Ship Plates, ¼in. and up	8 15 0	7 15 0
Sections	8 7 6	7 7 6
Steel Sheets, ¼in.	9 0 0	8 15 0
Sheets (Gal. Cor. 24 B.G.)	12 15 0	12 5 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 15 0	7 15 0
Angles	8 7 6	7 7 6
Boiler Plates (Marine)	10 10 0	—
" " (Land)	10 0 0	—
Joists	8 10 0	7 7 6
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	8 2 6	—
Soft Billets	6 17 6	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 10 0	—
Light Rails	8 15 0 to 9 0 0	—
Billets	6 15 0 to 9 10 0	—
MANCHESTER—		
Bars (Round)	9 7 6	—
" (Small Round)	7 15 0 to 8 0 0	—
Hoops (Baling)	10 0 0	9 15 0
" (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
" (Lancs. Boiler)	9 15 0	—
SHEFFIELD—		
Siemens Acid Billets	9 10 0 (basis)	—
Hard Basic	9 2 6 and 9 12 6	—
Intermediate Basic	7 12 6 and 8 2 6	—
Soft Basic	6 10 0	—
Hoops	9 15 0 to 10 0 0	—
Soft Wire Rods	8 0 0	—
MIDLANDS—		
Small Rolled Bars	8 0 0 to 8 15 0	—
Billets and Sheet Bars	6 0 0 to 6 12 6	—
Galv. Sheets, f.o.b. L'pool	11 17 6	—
Sheets (30 W.G.)	16 7 6	—
Angles	8 7 6	—
Joists	8 10 0	—
Tees	9 7 6	—
Bridge and Tank Plates	8 17 6	—
Boiler Plates	9 12 6	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	18/- to 18/3
Block Tin (cash)	134 7 6
" (three months)	136 5 0
Copper (cash)	48 5 0
" (three months)	47 17 6
Spanish Lead (cash)	18 0 0
" " (three months)	17 7 6
Spelter (cash)	15 15 0
" (three months)	16 7 6
MANCHESTER—	
Copper, Best Selected Ingots	55 0 0
" Electrolytic	56 0 0
" Strong Sheets	83 0 0
" Tubes (Basis Price), lb.	0 1 0
Brass Tubes (Basis Price), lb.	0 0 11
" Condenser, lb.	0 1 1
Lead, English	19 10 0
" Foreign	18 2 6
Spelter	16 10 0
Aluminium (per ton—raw ingot)	£95

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	3/1 per lb.	
Ferro Tungsten	2/10 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 12 6	7/-
" " 6 p.c. to 8 p.c.	£22 10 0	7/-
" " 8 p.c. to 10 p.c.	£22 0 0	7/-
" " Specially refined		
" " Max. 2 p.c. carbon	£33 10 0	10/-
" " " 1 p.c. carbon	£38 0 0	13/6
" " " 0·70 p.c. carbon	£39 0 0	15/-
" " " carbon free	11d. per lb.	
Metallic Chromium	2/7 per lb.	
Ferro Manganese (per ton)	£11 15 0 for home	
" "	£11 0 0 for export	
" Silicon, 45 p.c. to 50 p.c.	£11 10 0 scale 5/- per unit	
" " 75 p.c.	£19 0 0 scale 7/- per unit	
" Vanadium	12/9 per lb.	
" Molybdenum	4/2 per lb.	
" Titanium (carbon free)	9d. per lb.	
Nickel (per ton)	£170 to £175	
Ferro Cobalt	9/6 per lb.	

FUELS.

SCOTLAND.

(*Prices not stable.*)

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	12/6
" " Ell	13/3
" " Splint	14/- to 15/-
" " Trebles	12/- to 12/6
" " Doubles	11/9 to 12/-
" " Singles	11/- to 11/3
AYRSHIRE—	
(f.o.b. Ports)—Steam	13/3
" " Jewel	16/-
" " Trebles	12/6
FIFESHIRE—	
f.o.b. Methil or Burntisland—Steam	10/3 to 12/9
Screened Navigation	16/6 to 17/6
Trebles	13/- to 14/-
Doubles	11/6 to 12/-
Singles	11/6
LOTHIANS—	
(f.o.b. Leith)—Best Steam	11/6
Secondary Steam	11/-
Trebles	13/-
Doubles	11/6
Singles	11/6

ENGLAND.

	Inland.	Export.
(8) N.W. COAST—		
Steams		20/6 to 21/-
Household		32/- to 51/-
Coke		20/- to 21/-
NORTHUMBERLAND—		
Best Steams		13/6
Second Steams		12/-
Steam Smalls		10/- to 10/6
Unscreened		13/-
Household		25/- to 37/-
DURHAM—		
Best Gas		15/6
Second		13/3 to 13/6
Household		25/- to 37/-
Foundry Coke		24/- to 28/-
SHEFFIELD—	Inland.	
Best Hand-picked Branch	24/- to 25/6	—
Derbyshire Best Bright House	19/- to 21/-	—
Best House Coal	18/- to 19/6	—
Screened House Coal	16/- to 17/-	—
" " Nuts	14/- to 16/-	—
Yorkshire Hards	14/- to 15/6	—
Derbyshire Hards	14/- to 15/6	—
Rough Slacks	8/6 to 9/-	—
Nutty Slacks	7/- to 8/-	—
Smalls	3/- to 5/-	—
Blast-furnace Coke (Inland)	15/6 on rail at ovens	
Furnace and Foundry Coke (Export), f.o.b.		17/- to 18/6

CARDIFF— (9) SOUTH WALES.

Steam Coals:	
Best Smokeless Large	20/-
Second Smokeless Large	18/9 to 19/9
Best Dry Large	18/6 to 18/9
Ordinary Dry Large	17/6 to 18/-
Best Black Vein Large	18/3 to 18/6
Western Valley Large	18/- to 18/3
Best Eastern Valley Large	17/9 to 18/-
Ordinary Eastern Valley Large	17/6 to 17/
Best Steam Smalls	13/6 to 14/-
Ordinary Smalls	12/6 to 13/-
Washed Nuts	19/- to 22/-
No. 3 Rhondda Large	20/- to 20/6
" " Smalls	15/6 to 16/-
No. 2 " Large	17/- to 17/3
" " Through	16/- to 16/6
" " Smalls	14/- to 14/3
Foundry Coke (Export)	27/- to 37/-
Furnace Coke (Export)	21/- to 21/6
Patent Fuel	22/- to 22/6
Pitwood (ex ship)	27/6 to 27/9
SWANSEA—	
Anthracite Coals:	
Best Big Vein Large	35/- to 37/6
Seconds	27/6 to 31/6
Red Vein	23/6 to 27/-
Machine-made Cobbles	41/6 to 45/-
Nuts	40/- to 46/-
Beans	24/6 to 27/6
Peas	20/- to 21/-
Breaker Duff	10/- to 10/6
Rubbly Culm	12/3 to 13/-
Steam Coals:	
Large	19/6 to 20/6
Seconds	18/- to 19/6
Smalls	12/- to 13/-
Cargo Through	15/6 to 16/-

(1) Delivered. (2) Net Makers' Works. (3) f.o.b. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate: Joists (minimum), 12/6; Ordinary Ship, Bridge, and Tank Plates and Sections, 10/- if home consumers confine purchases from associated British Steel Makers.

French Engineering Notes.

(From our Correspondent in Paris.)

The Steel Comptoir.

THE arrangements for the international steel comptoir for raw steel and steel sections are now so far advanced that there is every prospect of the scheme being definitely established at an early date. The comptoir will centralise foreign business through the national syndicates; that is to say, makers will still be in direct touch with customers and the national syndicates will transmit the orders received to the international comptoir. Should the country receiving the order already have reached its quota the business will be passed on to another. Otherwise, the order will be returned to the national syndicate, which will, as far as possible, place it with the firm that received it. Practically, therefore, the relations between producers and consumers will remain unchanged, and it will only be in exceptional cases, in which it is necessary to provide for other firms, that orders will be diverted. Apart from the distribution of business to ensure that each country obtains its quota the effect of the comptoir's operations will be to exercise a rigid control over minimum prices for export. When the arrangements are completed for raw steel and steel sections negotiations will be begun for a similar control over the foreign business in merchant bars.

Public Works.

The increasing stagnation of trade has shown the necessity of doing something to ward off the general industrial crisis which may be expected to overtake this country unless the national programme of public works is put in hand forthwith. This plan seems to provide the only way out of the difficulty. A parliamentary report upon the financial means of carrying out the programme has been issued, and while the total expenditure over five years is 1700 million francs, the underlying principle of the scheme is to make as much use as possible of public investments. The savings of the country, it is remarked in the report, are enormous, and there should be no difficulty in utilising some of that money as loans for works of a national and even local character. Of the 1700 million francs only about one-half will be supplied by the State, the remainder being subscribed by the local bodies interested and by the public. It is intended to pass the Bill as rapidly as possible so as to allow of operations being resumed upon suspended works. Since German reparations have practically ceased the programme of works has come to a deadlock. The ports especially are clamouring for money to enable them to complete their extension schemes. One of the points particularly insisted upon in the parliamentary report is the necessity of a rural equipment whereby people may be induced to remain in the country. To that end money will be lent to local authorities to carry out works that will improve the conditions of living and encourage the population to settle on the land. The constant influx from the country to industrial centres is one of the most serious factors that have to be dealt with. Meanwhile progress with public undertakings is very slow, although there are so many of them that as soon as work can be resumed there will be plenty of activity. Amongst the new schemes is one for the construction of a viaduct between the Ile d'Oléron and the mainland. This viaduct will have a length of 3000 yards and a width between the balustrades of 24ft.

Social Charges.

The new social insurance scheme which has been held up for eighteen months on account of its unpopularity, and which has since its inception undergone many changes, came into operation last week, and there is some curiosity to know what effect it will have upon industry. The measure follows a long way after similar legislation in other countries It was feared that the additional charge would increase production costs and the cost of living, and threats have been freely made that the men would insist upon an advance in wages equal to the amount retained for insurance. This is not a time when wages can be increased under any circumstances. The men will accept the deduction from their wages because they cannot do otherwise, but it seems inevitable that the charge on employers will be added to the costs.

Railway Speeds.

The present year has seen an all-round acceleration of railway speeds, and there are 161 trains that exceed a speed of 53 miles an hour. The longest non-stop run on the Continent, between Paris and Liége, is made with the highest Continental speed of 62·4 miles per hour between the frontier and Paris, the distance of 147¼ miles being covered in 2 h. 22 m. The next fastest trains are also Nord *rapides* between Paris and Saint-Quentin, with a speed of 62 miles an hour. The highest electric speed is still obtained on the Midi line between Bordeaux and Dax, the average being 59¾ miles an hour. Except on the Orleans section between Les Aubrais and St. Pierre des Corps, on which the Sud Express covers the 69½ miles in 1 h. 8 m., and on the Midi section between Bordeaux and Dax, all the trains exceeding 58 miles an hour are on the Nord Railway. There has been a greater and more general acceleration on the railways with steam locomotives than on the electrified lines.

Water Congress.

The vast arid territory of Crau in the Bouches du Rhône was formerly a delta of the Durance and is now a dry stony country that produces nothing. Its fertility under irrigation has, nevertheless, been proved, and the P.L.M. Railway Company recently organised a congress at Marseilles to discuss new theories that may form the basis of a practical scheme for irrigating the Crau. The existence of underground streams flowing from the Durance to the sea is well known, and new methods are now to be employed to locate them and to prepare a general scheme of water elevation. There is also a proposal to irrigate the Crau with water from the Rhône when the plans for canalising that river are carried out, but the project is making little headway, and the utilisation of the subterranean water offers more immediate chances of transforming Crau into a fertile territory.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

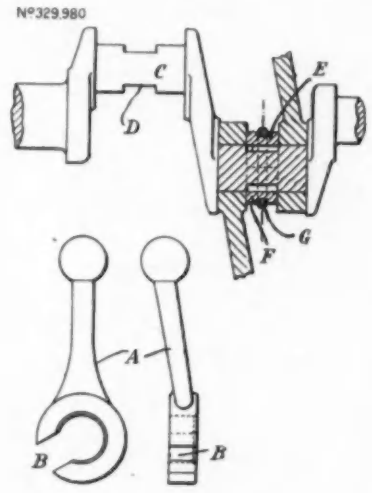
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM ENGINES.

329,980. February 28th, 1929.—CONNECTING-RODS AND CRANK SHAFTS, George Kent, Ltd., Frank Siddall, and Alexander Peet, all of Biscot-road Works, Luton, Bedfordshire.

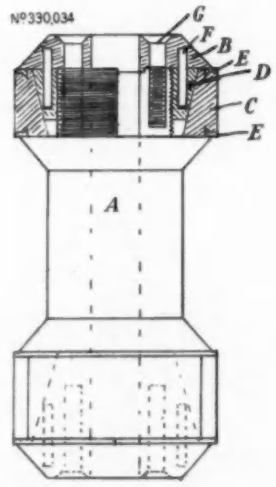
The connecting-rods A are provided with a gap B smaller than the diameter of the crank pins C of a crank, the crank pins being formed with central parallel "flats" D. To assemble the connecting-rods the gap B of one rod is passed over the flats



D and the connecting-rod is then moved along the pin until it is over one unflatted portion. The second connecting-rod is similarly placed in position, and afterwards the two parts E and F of a split collar are placed in position between the adjacent faces of the connecting-rods and the spring clip G is sprung into a groove formed in the split collar, the spring clip forcing the collar into contact with the circular portions of the crank pin.—*May 28th*, 1930.

330,034. March 22nd, 1929.—AN ADJUSTABLE SOLID PISTON VALVE, John William Docherty, of 274, Brockley-road, London, S.E. 4.

According to the invention, a cone is screwed on to the piston valve body and is prevented from turning when assembled by pegs in engagement with the junk ring and a series of holes in the cone. A is the piston valve body screwed at each end, on which is screwed a cone D, the outside of which is angled to

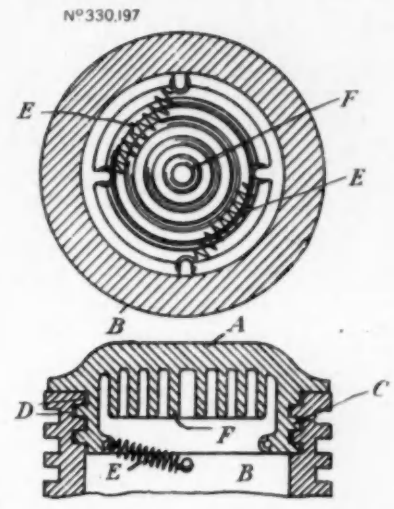


that of the inside of the ring segments C. B is the junk ring. When screwed down the junk ring B locks the cone D as the pegs F are in engagement with both. E are tongue rings at each end of the packing ring segments, which by covering the split parts of the ring segments C, prevent leakage and also serve to hold the segments together whilst assembling. The tongue ring is split in one place. The piston valve is designed to prevent leakage without causing excessive wear of the walls of the valve chest or cage, and without causing strains on the operating gear.—*June 5th*, 1930.

INTERNAL COMBUSTION ENGINES.

330,197. September 23rd, 1929.—A PISTON FOR INTERNAL COMBUSTION OR OTHER ENGINES, Walter Zechlau, of 68, Langestrasse, Berlin, O. 17, Germany.

The piston described in this specification may be made of different materials having different rates of expansion. For example, the piston head may be made of light metal and the skirt of iron. The piston head A is screwed to the piston skirt B by means of a square thread C. In order to prevent fracture of the piston skirt B by the more expansible piston head on rise of temperature, a certain amount of space for play is provided at D between the inner and outer threads. Heat radiating ribs F are provided on the bottom of the piston head. The piston head is held tightly in the screwed-on position by means of one or more stretched springs E, the ends of which are secured respectively to the head and to the skirt, and the springs tend to impart rotational displacement to the head, and thus prevent

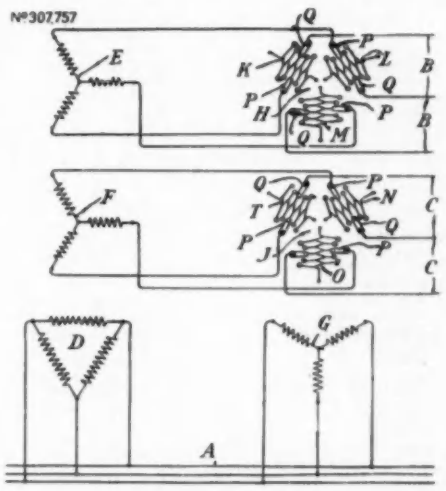


the head from becoming loose on the skirt on rise of temperature, and when the piston is submitted to shocks. The relative positioning of the heat-radiating ribs F and the springs E is such that the springs are not excessively heated by heat due to the ribs.—*June 5th*, 1930.

TRANSFORMERS AND CONVERTERS.

307,757. March 12th, 1929.—ALTERNATING-CURRENT TRANSFORMERS, The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C. 2.

The invention relates to alternating-current transformers, and more particularly to an improved arrangement for adjusting and controlling the phase angles of the voltages and currents in circuits to which such transformers are connected. A three-phase circuit A supplies power to or receives power from two other three-phase circuits B and C. A delta connected winding D is connected to the circuit A, and is indicated as being inductively related to two star-connected windings E and F. A star-connected winding G is also connected to the circuit A and is indicated as being inductively related to two sets or groups of windings H and J. The group H includes three separate and unconnected auxiliary windings K, L, and M, with their voltages respectively at right angles to the voltages in the three phases of the winding E. The group J includes three separate and unconnected auxiliary windings N, O, and T, with their voltages respectively at right angles to the voltages in the three phases of the winding G. The directions or positions of the various windings shown in the drawing indicate the phase angle relations of the voltages in these windings. Each of the windings K, L, and M is provided with two sets of taps distributed along the winding and connected respectively to two tap switches P and Q.

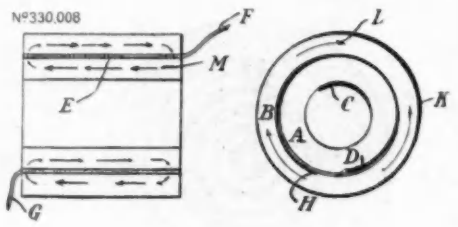


The movable contacts of the three switches Q are connected to the three conductors of the outside circuit B. The movable contact of each of the switches P is connected to that phase of the winding E in which the voltage is at a right angle to the voltage in the tapped winding to which the switch is connected. The positions of the tap switches P and Q determine the number of turns of the tapped windings which are connected in series with their respective phases of the winding E. Thus, a voltage may be obtained in series with and at right angles to the voltage of each of the phases of the winding E. It will be apparent that this voltage in the tapped windings may be adjusted in value and reversed in direction by suitable adjustments of the switches. The obvious effect of varying the voltages in the tapped windings K, L, and M is to vary the phase angles of the voltages and currents in the conductors of the circuit B. This phase adjustment will have only slight effect on the value of the voltage impressed on the outside circuit B, and if such voltage adjustment is also desired, it may be secured by any other well-known means. The windings N, O, and T are provided with taps and with tap switches P and Q, and are connected between the phases of the winding F and the conductors of the outside circuit C. Thus, the phase angles of the voltages and currents in the conductors of the circuit C may also be varied and adjusted as desired.—*June 5th*, 1930.

330,008. March 5th, 1929.—ELECTRIC TRANSFORMERS, The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C. 2, John Gale Wellings, of "Ricky," London-road, Dunchurch, Rugby, and Charles Gilbert Mayo, of 17, Alexandra-road, Rugby.

Briefly, this invention consists in providing means for improving the accuracy of current transformers by providing an

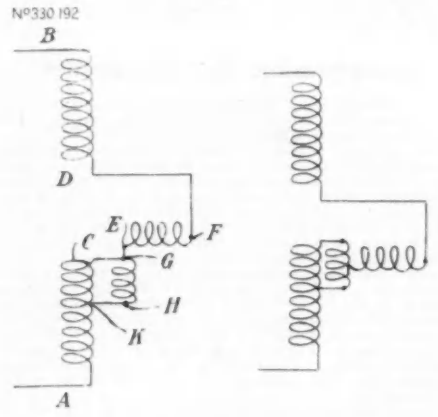
auxiliary winding within the core, which, when energised, serves to produce a flux in the core, which is at right angles to the direction of the main working flux. A represents the inner core section and B the outer core section. The spirally wound strip starts at C and ends at D for the inner core. The auxiliary



winding E is then wound on starting at F and ending at G, after which the outer core section of strip is wound, starting at H and ending at K. The normal working flux is represented by arrows at L, whilst the superimposed magnetising flux at right angles due to the ancillary winding is represented by the arrows M.—*June 2nd*, 1930.

330,192. August 31st, 1929.—VOLTAGE CONTROL OF ELECTRIC TRANSFORMERS, The Electrical Apparatus Company, Ltd., and Ralph Henry Barbour, of Vauxhall Works, South Lambeth-road, London, S.W. 8.

The invention applies to the control of the voltage of a single or polyphase transformer. In accordance with the invention, each phase is in general controlled separately, and the description therefore is given as applying to a single-phase transformer. A B are the main output terminals of a transformer secondary winding, shown divided at the points C, D. E and F are the terminals of the secondary winding of an induction regulator, this secondary winding being shown connected to the

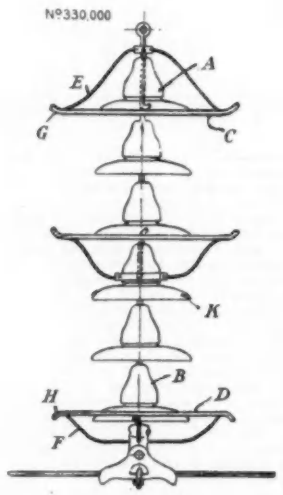


points C D of the transformer secondary winding. The terminal G of the primary winding of the induction regulator is connected to terminal C of the transformer secondary winding. The other terminal H of the induction regulator primary winding is connected to terminal K, so that the primary winding G H is connected across part only of the secondary winding of the transformer. One of the advantages of the invention is that the total voltage between any two parts in the regulator itself need only be the amount by which it can vary the voltage of the transformer. This in normal cases is, say, 10 or 20 per cent., and thus the maximum potential between any points on the regulator is only 10 or 20 per cent. of the line voltage of the transformer being controlled. An alternative arrangement is shown in the right-hand illustration.—*June 5th*, 1930.

ELECTRICAL APPLIANCES.

330,000. February 27th, 1929.—ARC GUARDS FOR INSULATOR CHAINS, *Justin Erwin Pollak, of* 20 *to* 23, *Holborn, London, E.C.* 1.

In electrical suspension and terminal strain insulator chains, it is of great importance to counteract the destruction owing to short-circuit arcs of the individual insulator cores. According to one scheme described in this specification, means are pro-

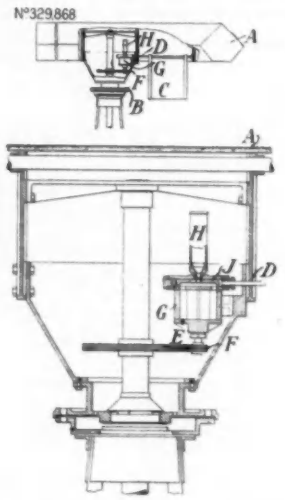


vided to prevent the arc from being too readily driven on to the chain or into it by the wind and other actions. The chain in this case is provided with protecting fittings, not only on the two extreme elements, but also on one of its intermediate members. The uppermost member A, as well as the lowest member B, are equipped with protecting fittings which consist of protecting rings C D, and are combined with cross horn pairs E F, the points G and H of which project beyond the rings. A fitting such as that on the uppermost member A is also arranged on one of the central members K. In the event of an arc being formed between the rings C and D or the points G and H, and driven by wind pressure or other action into the chain, the intermediate fitting affords a footing for the arc.—*May 29th*, 1930.

MEASURING AND TESTING INSTRUMENTS.

329,868. June 14th, 1929.—WIND DIRECTION INDICATORS, Chance Brothers and Co., Ltd., Alexander Hamilton and Herbert Osborn Wraith, all of Lighthouse Works, Smethwick, Stafford.

This invention relates to wind direction indicators employed more particularly in connection with aviation. The object of the invention is to minimise or obviate the overswing and oscillations which are liable to be set up by the action of sudden wind gusts. The indicator comprises, as usual, a hollow tee-shaped body A rotatably mounted on a vertical axis at the upper end of a standard B. A vane C is attached to a horizontal

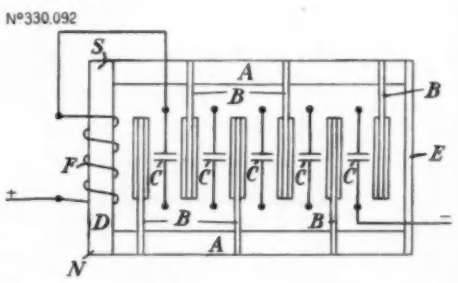


pivot shaft D. On a fixed central shaft within the indicator a fixed toothed wheel E is secured, the periphery of which engages a pinion F secured to one of the spindles of a gear-type pump G, which is carried within the movable part A. Movement of the part A about the wheel E produces rotation of the pump. The casing of the pump is filled with oil and the action of the pump is to displace this oil into a closed receptacle H. The outlet between the pump and receptacle is closed by an oscillatory valve J on the shaft D carrying the vane. Deflection of the vane to either side of its central position restricts the outlet from the pump and thereby sets up the desired resistance to movement of the indicator.—*May 29th*, 1930.

TRAMWAYS AND RAILWAYS.

330,092. May 1st, 1929.—MAGNETIC BLOW-OUT DEVICES FOR ELECTRIC CURRENT CONTROLLERS, The Electro-Mechanical Brake Company, Ltd., and George Norman Cadbury, both of Eagle Works, West Bromwich.

The object of this invention is to provide a simple and improved magnetic blow-out device in combination with an electric current controller, for extinguishing the arcs set up when the current is broken. A pair of iron or steel bars A form limbs of an electro-magnet on opposite sides of and parallel with a controller spindle—not shown. To each of the limbs pole pieces B are secured and extend laterally at right angles to the limbs into the gaps between the usual contacts of the controller which are represented diagrammatically at C. The two sets of pole pieces B alternate with each other and form complementary pairs, their disposition being such that between each pair there can be formed a magnetic field, the direction of which is parallel

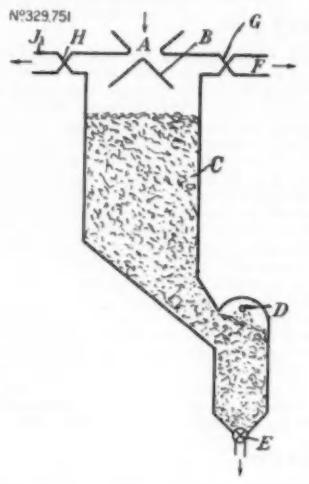


with the controller spindle, or at right angles to the plane of the contacts C situated between each pair of pole pieces. At one end the limbs A are joined by a transverse iron or steel member D and at the other end they may be interconnected by a bar E of any suitable non-magnetic material. Preferably a single exciting coil F is used, and this is preferably mounted on the transverse member D. The transverse member D is magnetised by the coil F, so that one end—the lower end in the drawing—becomes a north pole, and the other—the upper end in the drawing—a south pole. Hence the pole pieces B, which are secured to opposite ends of the member D, are correspondingly polarised. By means of the arrangement, the required magnetic fields are set up between each of the movable contacts C, so that when an arc occurs it is deflected by the field and extinguished. —*June 5th*, 1930.

MISCELLANEOUS.

329,751. March 23rd, 1929.—THE COOLING OF COKE, Daniel Tyrer, of Norton Hall, The Green, Norton-on-Tees, Durham, and Imperial Chemical Industries, Ltd., of Imperial Chemical House, Millbank, London, S.W. 1.

This invention relates to a process of and apparatus for cooling coke, discharged from coke ovens in which the heat of the coke is largely utilised to form water gas. Hot coke from the coke ovens is charged through the aperture A, which can be closed by the valve B into the relatively deep vessel C, which is of the shape shown. It passes down this vessel and is cooled by the water spray D and eventually discharged in the cool state through the valve E. The steam produced rises up through the coke, is converted to water gas by the very hot coke and removed through



the pipe F and valve G. When the coke has cooled down so much that the water gas reaction is no longer possible, the valve G is closed and the valve H on the pipe J is opened and the steam passes out by this pipe.—*May 29th*, 1930.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

BRITISH WATERWORKS ASSOCIATION.—Nineteenth Annual Meeting at Liverpool.

TO-DAY AND SATURDAY, JULY 12TH.

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.—Manchester.

MONDAY, JULY 14TH TO FRIDAY, JULY 18TH.

INSTITUTION OF NAVAL ARCHITECTS.—Summer meeting at Liverpool.

WEDNESDAY, JULY 16TH.

MANCHESTER ASSOCIATION OF ENGINEERS.—Visit to the Burnage Works of Hans Renold, Ltd. Assemble at the works at 2.30 p.m.

WEDNESDAY, JULY 23RD.

INSTITUTION OF CIVIL ENGINEERS: BIRMINGHAM AND DISTRICT ASSOCIATION.—Visit to the Leicester Corporation Waterworks. Leave Birmingham at 9 a.m.

WEDNESDAY TO WEDNESDAY, SEPTEMBER 3RD TO 10TH.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—Bristol meeting. The presidential address, by Professor F. O. Bower, will deal with "Size and Form in Plants." Evening discourses will be given by Professor E. V. Appleton, F.R.S., on "Wireless Echoes," and by Dr. R. E. Slade on "The Nitrogen Industry and our Food Supply." Evening receptions and excursions to points of scientific interest, works, &c., in the locality will be arranged.

THURSDAY TO SUNDAY, SEPTEMBER 4TH TO 7TH.

INTERNATIONAL CONGRESS OF CONSULTING ENGINEERS.—Fifth Congress at Vienna.

WEDNESDAY TO TUESDAY, SEPTEMBER 10TH TO 16TH.

INSTITUTE OF METALS.—Annual autumn meeting at Southampton.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

BRUCE PEEBLES AND CO., Ltd., Edinburgh, have taken more commodious offices at Standard Buildings, Leeds, their telephone number now being 25816. Mr. Cecil C. Higgens, A.M.I.E.E., is in charge of the Leeds office, as hitherto.

J. F. CROWLEY AND PARTNERS inform us that they have acquired the lease of Westminster House, Great George-street, Westminster, London, S.W. 1, which affords considerably larger and more convenient accommodation, particularly for their laboratories, and that their offices have now been transferred to that address.

NEW depôts have been opened by the Metropolitan-Vickers Electrical Company, Ltd., for the sale of "Cosmos" lamps in the Glasgow and Birmingham districts. In the case of Glasgow the company's meter business will be conducted from the same address. The Glasgow area office is at 177, West George-street, Glasgow; and the Birmingham area office at International Exchange Buildings, Edmund-street, Birmingham.

LAUNCHES AND TRIAL TRIPS.

SAN ANTONIO, steamship; built by Harland and Wolff, Ltd., to the order of Compagnie Generale Transatlantique; dimensions, 430ft. by 57ft. by 37ft. 6in.; gross tonnage, 5990. Engines, four-cylinder triple-expansion, 31in., 50in., 60in. and 60in. diameter by 60in. stroke, pressure 205 lb. per square inch; constructed by the builders; this ship is the first of six similar cargo vessels; launch, July 1st.

TALISSE, motor ship; built by Caledon Shipbuilding and Engineering Company, Ltd., to the order of Stoomvart Maatschappi "Nederland;" dimensions, 465ft. by 62ft. by 36ft. 3in.; gross tonnage, 8230. Engine, eight-cylinder, two-cycle, single-acting, reversible Diesel; constructed by Sulzer Bros.; trial trip, July 1st.